ಪೂರ್ಣದ ಪೂರ್ಣವನ್ನು ತೆಗೆದರೂ, ಪೂರ್ಣವೇ ಉಳಿಯುವದು.

ಪ್ರಾಚೀನ ಗಣಿತ ಶಾಸ್ತ್ರ.

ಪೂರ್ಣಮದಃ ಪೂರ್ಣಮಿದಂ ಪೂರ್ಣಾತ್ ಪೂರ್ಣಮುದಚ್ಯತೇ।
ಪೂರ್ಣಸ್ಯ ಪೂರ್ಣಮಾದಾಯ ಪೂರ್ಣಮೇವಾವಶಿಷ್ಯತೇ॥
[illegible]:- ಅದು ಪೂರ್ಣ, ಇದು ಪೂರ್ಣ, ಆ ಪೂರ್ಣದಿಂದ ಪೂರ್ಣವನ್ನು ತೆಗೆದರೂ,

ನಮ್ಮ ಉಪನಿಷತ್ತುಗಳ ಶಾಂತಿ ಪಾಠದಲ್ಲಿ ಬಂದಿರುವ ಶ್ಲೋಕವನ್ನು ಸರಿಯಾಗಿ ಪರಿಶೀಲಿಸಿದರೆ ಅಷ್ಟು ಪ್ರಾಚೀನ ಕಾಲದಲ್ಲಿಯೇ ನಮ್ಮ ಪೂರ್ವಜರು ಗಣಿತಶಾಸ್ತ್ರದಲ್ಲಿಯೂ ಎಷ್ಟು ಪ್ರಾವೀಣ್ಯವನ್ನು ಪಡೆದಿದ್ದರೆಂಬುದನ್ನು ನಾವು ಮನಗಾಣಬಹುದು. ಪರಮಾತ್ಮನನ್ನೇ ಪೂರ್ಣ ಅಂದರೆ ಸ್ವತಃ ಪೂರ್ಣನೂ ಸಂಖ್ಯೆಗಳ ಪೂರ್ಣ ಪರಮಾವಧಿಯೊಂದು ಕಲ್ಪಿಸಿ, ಅಂಥಾ ಪೂರ್ಣದಿಂದ ಪೂರ್ಣವನ್ನು ಕಳೆದರೂ ನಿಃಶೇಷಗೊಳಿಸಿದರೂ, ಪೂರ್ಣವೇ ಬಾಕಿ ಉಳಿಯುವದೆಂದು ಅತಿ ಸೊಗಸಾಗಿ ಬಣ್ಣಿಸಿದ್ದಾರೆ. ನಾಲ್ಕು ಉಪವೇದಗಳಾದ ಧನುರ್ವೇದ, ಆಯುರ್ವೇದ, ಗಂಧರ್ವವೇದ, ಅರ್ಥಶಾಸ್ತ್ರಗಳಲ್ಲಿ ಈ ಗಣಿತ ಶಾಸ್ತ್ರಕ್ಕೆ ಪ್ರತ್ಯೇಕವಾದ ಸ್ಥಾನವು ಕಲ್ಪಿಸಲ್ಪಡದಿದ್ದರೂ, ಆರು ವೇದಾಂಗಗಳಲ್ಲಿ ಪ್ರಮುಖವಾಗಿ ಕಂಗೊಳಿಸುತ್ತಿರುವ ಜ್ಯೋತಿಷವನ್ನೇ ಆಧಾರವಾಗಿಟ್ಟುಕೊಂಡು ಬಂದಿರುವ ಗಣಿತ ಶಾಸ್ತ್ರವನ್ನು ನಿರ್ಲಕ್ಷ್ಯ ಮಾಡಿದ್ದರಿಂದ ಸರ್ವಥಾ ಆದರಣೀಯ ದೇನೂ ಸೋಜಿಗದ ವಿಷಯವಲ್ಲ. ಯಜ್ಞ ಯಾಗಾದಿ ಪ್ರಶಸ್ತವಾಗಿರುವ ನಮ್ಮ ಕರ್ಮಗಳನ್ನು ಪೂರೈಸುವರೆ ಗಣಿತಜ್ಞನ ಸಹಾಯವು ಅಪೇಕ್ಷಿತವಾಯಿತು. ಅವುಗಳಿಗೆ ಬೇಕಾಗುವ ಮಂಡಲ ತ್ರಿಕೋಣಾದಿಗಳನ್ನು ರಚಿಸುವರೆ ಶುಲ್ಬಸೂತ್ರವೆಂದು ಪ್ರಸಿದ್ಧ ಗ್ರಂಥವು, ಈಗ Geometry ಎಂದು ಪ್ರಸಿದ್ಧವಾಗಿರುವ ಶಾಸ್ತ್ರಕ್ಕೆ ಆಧಾರಭೂತವಾಗಿ, ಗಣಿತಶಾಸ್ತ್ರದ ಇನ್ನೊಂದು ಪ್ರಮುಖವಾದ

ಜನರ ಬೇಸಾಯಕ್ಕೆ ಇದು ಅತ್ಯವಶ್ಯಕವಾಯಿತು. ಗ್ರಹಣಾದಿಗಳು, ನಕ್ಷತ್ರ
ಗಳ ಸ್ಥಾನಮಾನ, ಸ್ಥಾನ ಚಲನಾದಿಗಳನ್ನು ಕಂಡುಹಿಡಿಯುವರು, ಇತಿಹಾ
ಸಕಾರರ ಅಭಿಪ್ರಾಯದಂತೆ 'ಸಿಂಧೂ' ನದಿ ನಾಗರಿಕತೆಯ ಕಾಲದ
ಮೊದಲು ಹಿಮಾಲಯದ ಜ್ಯೋತಿಷಿಗಳು ದಿನ, ವಾರ, ಪಕ್ಷ,
ಮಾಸ, ಋತು, ಅಯನ, ಇತ್ಯಾದಿ ಸ್ಥಳಗಳನ್ನು ಸ್ಥಾಪಿಸಲ್ಪಟ್ಟವು
ಜ್ಯೋತಿಷವು ವೇದಗಳ ಅಂಗವೆಂದು ನಾವು ತಿಳಿ
ಯಬೇಕು. ಗಣಿತಶಾಸ್ತ್ರ ಮತ್ತು ನಕ್ಷತ್ರವಿದ್ಯೆ ಎಂದೇ ವಿದ್ವಾಂಸರು
ತಿಥಿ, ವಾರ, ನಕ್ಷತ್ರ, ಕರಣ, ಯೋಗ ಎಂಬ ಪಂಚಾಂಗಗಳನ್ನು
ಜ್ಯೋತಿಷ ಶಾಸ್ತ್ರದ ಸಹಾಯದಿಂದ ನಿರ್ಮಿಸಿದರು. ಕ್ರಿಸ್ತಪೂರ್ವ
ಶತಮಾನದಲ್ಲಿ ಆಗಲೇ ಬೌದ್ಧ ಸಾಹಿತ್ಯ ಗ್ರಂಥಗಳಲ್ಲಿ ಗಣಿತವು
ಇತ್ತೆಂದು ನಾವು ಅವುಗಳಿಂದ ತಿಳಿಯುತ್ತೇವೆ. 165 ಕ್ರಿಸ್ತಪೂರ್ವದಲ್ಲಿ
ಲವೆಂಬ ರಾಜನ ಶಿಲಾಶಾಸನದಲ್ಲಿ ಬರೆದ ಸಂಖ್ಯೆಗಳು, ಕಾಲು, ಅರ್ಧ,
ಮುಕ್ಕಾಲು ದಿನವೆಂಬುದು ಜೋಡಿಲೆಕ್ಕ, ದಶಮ, ಚತುರಸ್ರ
ವನ್ನು ಕಂಡುಹಿಡಿಯುವ ರೀತಿ, ಈ ತರದ ಗಣಿತಗಳನ್ನು ನಾವು ಕಾಣಬಹುದು
ಆರ್ಯಭಟ ಸೂತ್ರ ನಿಲ್ಲದವರೇ ಈ ಜ್ಯೋತಿಷ ಸಂಪತ್ತು ಇ
(Tangent A-B)
ಆರ್ಯಭಟ ಸೂತ್ರ ಜ್ಯೋತಿಷ್ಯ ಗಣಿತಜ್ಞ ಎಂಬುದು ಕೆಲವರ
ಲ್ಲಿ ತಿಳಿದಿದೆ. ಆವನ ಕಾಲದಲ್ಲಿ ಜ್ಯೋತಿಷ ಗಣಿತವನ್ನು ಪ್ರತ್ಯಕ್ಷ
ಗಣಿತ, ಪರಿಕರ್ಮ ಗಣಿತ, ವ್ಯವಹಾರ ಗಣಿತ, ರೇಖಾ ಗಣಿತ(Geometry), ತ್ರೈ
ಗಣಿತ(Rule of three), ಭಿನ್ನ ರಾಶಿ ಗಣಿತ(fractions) ಯಾವತ್ತಾವತ್
(Algebra, ಯಾವತ್ತಾವತ್ = unknown quantity = x), ವರ್ಗ ಘನ ...

quadratic equation, Arithmetical or Geometrical progression
ಆದಿ ಮಿಶ್ರಧನ, ಘನಮೂಲ (cubic root), ವರ್ಗಮೂಲ (square root)
indeterminate equations ಇವೆಲ್ಲ ಬೀಜಗಣಿತದ ಸಮೀಕರಣ ಇತ್ಯಾದಿ
ವಿಷಯಗಳನ್ನೊಳಗೊಂಡಿದೆ. ಇದನ್ನು 9ನೆಯ ಶತಮಾನದ ಪ್ರಖ್ಯಾತ ಗಣಿತಜ್ಞ
ಇವೆಲ್ಲವನ್ನು ನಿರ್ದೇಶಿಸಿ
ಶ್ರೀಧರ ಅವರು ವಂಶ ಭಾಗಗಳು fractions, ವ್ಯಸ್ತ ತ್ರೈರಾಶಿಕ (inverse
rule of three), ಸಪ್ತರಾಶಿ, ನವರಾಶಿ, ಭಾಂಡ ಪ್ರತಿಭಾಂಡ (barter
and exchange) ಇತ್ಯಾದಿ ಹೊಸ ವಿಷಯಗಳನ್ನು ನಿರ್ದೇಶಿಸಿದನು. ಧೂಳೀ
ಕರ್ಮ ಮತ್ತು ಪಾಟೀಗಣಿತ ಎಂಬ ಎರಡು ತರದ ಗಣಿತಗಳನ್ನು ಹೊಸ
ರಲು ಪ್ರತಿಪಾದಿಸಿದವನು ಶ್ರೀಧರನು. ಧೂಳಿ ಎಂದರೆ ಧೂಳು, ಪಾಟಿ
ಎಂದರೆ ಬೋರ್ಡು, ಅಥವಾ ಈಗಿನ ಬೋರ್ಡಿನ ಮೇಲೆ chalk ನಿಂದ
ಹಾಕುವ ಅಕ್ಷರದ ಲೆಕ್ಕಗಳನ್ನು ಮಾಡುವುದಂತಹ ಹಿಂದಿನವರನ್ನು ಮರೆ
ಇವು ಅರಬೀ ದೇಶದವರು ಇದೇ ಕಾರಣದಿಂದ ಇದಕ್ಕೆ ಹಿಸಾಬ್ ಅಲ್ ಘು
ಬೇರ್ ಎಂದು ಕರೆಯುತ್ತಾರೆ. ಗ್ರೀಕರಿಗೂ ಇದು ಉತ್ತರ ಆಫ್ರಿಕಾ ಸಮಾಗಮದಿಂದ
ಖಂಡಕ್ಕೆ ವ್ಯಾಪಿಸಿ ಅಬ್ಯಾಕಸ್ ಅಬಾಕಿ ಎಂದರೆ ಧೂಳಿಯ ಲೆಕ್ಕ ಎಂ
ಎಂದು ಹೆಸರಾಯಿತು. ವರ್ಗ ಸಮೀಕರಣಗಳನ್ನು ಬಿಡಿಸುವ ಕ್ರಮದಲ್ಲಿ
ಶ್ರೀಧರನು ಮೊದಲಿಗನು. ಈಗ ನಮ್ಮ ಗಣಿತದ ಎಲ್ಲ ಪ್ರಶ್ನೆಗಳನ್ನು ಉತ್ತರಿಸ
ಬ್ರಹ್ಮಸ್ಫುಟ ಸಿದ್ಧಾಂತದ
ಸಲು ಕಾಲವಾಗಿದೆ. 18ನೆಯ ಅಧ್ಯಾಯದ ಶ್ಲೋಕದಲ್ಲಿ (ಪ್ರಾಂಶೋ
ಯುತ: ಪ್ರಾಜ್ಞ: ಕುಟ್ಟಕಾರಾದ್ಯಶೇಷ ನವಾಂಶೇ ವಿಜ್ಞಾನಂ) ಎಂದು ಹೇಳಿದ್ದಾನೆ
ಆಧಾರವಾಗಿ ಒಂದು ಭಿನ್ನರಾಶಿಯನ್ನು ಅವ್ಯಕ್ತಗಣಿತ ಅರ್ಥಾತ್
ಗಣಿತವೆಂದು ಹೊಸದಾಗಿ ಆರ್ಯಭಟನ ದಲ್ಲಿ ಉಳಿಸಿದವನು

ಈ ಬ್ರಹ್ಮ ಸೂತ್ರವನ್ನು ಕುರಿತು ಭಾಸ್ಕರಾಚಾರ್ಯ ಸಮಾಲೋಚನಾ ಭಾಗದ ಮೊದಲಲ್ಲಿ…
ಎಂದು ಹೇಳಿದ್ದು ಯಥಾರ್ಥವಾದದ್ದೇ. ಇವನು ಬ್ರಹ್ಮಸ್ಫುಟಸಿದ್ಧಾಂತ ಮತ್ತು ಖಂ…
ಖಾದ್ಯಕ ಎಂಬ ಎರಡು ಗ್ರಂಥಗಳನ್ನು ಬರೆದಾತನು. ಈತನ ಎರಡನೇ ಗ್ರಂಥವು ಆರ್ಯ…
ಭಟನ ಅರ್ಧರಾತ್ರಿಕ ಕ್ರಮದ ಪ್ರಕಾರ ಗ್ರಹಗಳ ಅಕ್ಷಾಂಶ ರೇಖಾಂಶಗಳನ್ನು ಉಪಯೋಗಿಸಿ…
ಗಣಿತಿಸಿ ಗಳನ್ನು ಕೊಡುತ್ತದೆ. ಲಂಕೆಯೇ ಆ ಕಾಲದ ಗ್ರೀನ್‌ವಿಚ್ ಆಗಿದ್ದಿತು…
ಅಲ್ಲಿಯ ಮಧ್ಯರಾತ್ರಿಯಲ್ಲಿ ಗ್ರಹಗಳ ಅಕ್ಷಾಂಶ, ರೇಖಾಂಶ ತಾತ್ಕಾಲಿಕ ದೈನಂದಿ…
ಗತಿ ಇತ್ಯಾದಿಗಳ ವಿಚಾರಗಳನ್ನು ವಿವರವಾಗಿಸುತ್ತದೆ. ಬ್ರಹ್ಮಸೂತ್ರನೇ ಭಾಸ್ಕ…
ರಾಚಾರ್ಯನ ಶಿಷ್ಯನಿಗೆ ಆಧಾರಸ್ತಂಭದಂತಿದ್ದವನೆಂದು ನಾವು ಒಪ್ಪಬೇಕಾಗು…
ಮಹಾವೀರ, ಶ್ರೀಧರ, ಭಾಸ್ಕರ ಇತ್ಯಾದಿ ಗಣಿತಜ್ಞರೆಲ್ಲರೂ ಇವನನ್ನೇ…
ಅನುಸರಿಸಿದರು. ಕ್ಷೇತ್ರಗಣಿತವನ್ನು ಕೂಲಂಕಷವಾಗಿ ಚರ್ಚಿಸಿದ್ದಾನೆ. ಆವೃತ್ತ ಚ…
(cyclic quadrilateral)
ತುರ್ಭುಜ ಕ್ಷೇತ್ರವನ್ನು ಭಾಸ್ಕರಾಚಾರ್ಯನು ಕಂಡುಹಿಡಿದನು ಇವನೇ ಅದರ ಬಾಹು…
ಬಾಹುಗಳು a, b, c, d ಎಂದಾದರೆ $(s-a)\times(s-b)\times(s-c)\times(s-d)$ ಇ…
ದರ ವರ್ಗಮೂಲವೆಂದು ಕಂಡುಹಿಡಿದನು. ಇಲ್ಲಿ s = ಆವೃತ್ತ ಚತುರ್ಭುಜದ ಸುತ್ತ…
ಳತೆಯ ಅರ್ಧ. ಇವನು decimal numeration ದ ಸಂಕಲನ ಗಣಿತವನ್ನು ಅ…
ರಿಯುದಂತೆ Prof W.W.R. Ball ಎಂಬ ಈಗಿನ ಸುಪ್ರಸಿದ್ಧ ಗಣಿತಜ್ಞನು…
ತಿಳಿಸುತ್ತಾರೆ. ಈತನ arithmetic progression (ಸಮಾನಾಂತರ ಶ್ರೇಢಿ) ದ…
ವ್ಯವಹಾರ ಉದಾಹರಣೆಯಾಗಿದೆ -

ಏಕಾದ್ಯಾ: ನವಪರ್ಯಂತಾ: ವಣಿಜ್ಜೈವರ್ಣಲಬ್ಧಿ:।
ತ್ರಿಕೋಣಯೋಜನಾ ವಿಕ್ರೇತ: ಪಂಚಕೋಣೈ: ಪಂಚಭುಜೈ:

೯ ಸಂಖ್ಯಾವರ್ಣಗಳು 1, 2, 3, 4, 5, 6, 7, 8, 9 ಈ ಕ್ರಮದಲ್ಲಿ ಸಾಲಾಗಿ…

ಒಟ್ಟಿನಲ್ಲಿ

ಶಿಷ್ಯ ಸುಮತಿಯನ್ನು ಕೊಂಡುಕೊಂಡು, ಒಟ್ಟಿನಲ್ಲಿಯೇ 495 ರೂಪಾಯಿಗೆ [illegible]

ಮಾರಿದರೆ, ಒಬ್ಬೊಬ್ಬನಿಗೆ ಸಿಕ್ಕಿದ ಬೆಲೆ ಎಷ್ಟು. ಉತ್ತರ 11, 22, 33, … [illegible]

99. ಇಲ್ಲಿಯೇ ಇನ್ನೊಂದು ಗಣಿತ - 18ನೇ [illegible]

[illegible] 6ನೇ [illegible]

[illegible] ಇವನ ಪ್ರಕಾರ [illegible] 10ನೇ [illegible]

[illegible] $ax^2+1=by^2$ (indeterminate equations) ಎಂದು ~~[illegible]~~ [illegible]

~~[illegible]~~ [illegible] ನಂತರ ಕಂಡುಹಿಡಿದ ವಿಷಯವನ್ನು [illegible]

[illegible] π ಇದರ ಬೆಲೆಯನ್ನು ಇವನು [illegible] 3.1416 ಎಂದು [illegible]

[illegible] ಎಂದು ಹೇಳುತ್ತಾರೆ. (ಕ್ರಿ. 4-477 A.D)

ಮಹಾವೀರ ಆಚಾರ್ಯನು ಅಮೋಘವರ್ಷ ನೃಪತುಂಗನ ಕಾಲದಲ್ಲಿದ್ದ [illegible]

[illegible] ಇವನು ಗಣಿತ ಸಾರಸಂಗ್ರಹವನ್ನು [illegible]

[illegible]

ಲಘುಕರಣ [illegible]

ವೃತ್ತ ಕ್ಷೇತ್ರ [illegible]

ಸುಲಭ [illegible] ಎಂದು ತಿಳಿಯುವನ್ನು [illegible]

[illegible]

[illegible]

Sir William Jones ಎಂಬ ಪ್ರಸಿದ್ಧ ಪಾಶ್ಚಾತ್ಯ ತಜ್ಞ [illegible]

~~[illegible]~~ [illegible]

[illegible] ಭಾರತೀಯರ [illegible]

[illegible] ನಮ್ಮ [illegible] ದಿಂದ ನಮ್ಮ ದೇಶದ [illegible] ಸಂಖ್ಯೆ [illegible]

ಸ್ಥಾನೀಕರಣದಲ್ಲಿ Arabic numbers ಎಂದು ಹೆಸರಾಗಿದೆ. ಈಗ Pytha-
theorem ಎಂದು ಪ್ರಸಿದ್ಧವಾಗಿ ಗ್ರೀಕ್ ದೇಶದಲ್ಲಿ ಉತ್ಪತ್ತಿಯಾದುದೆಂದು ಅಪಪ್ರಚಾರ-
ವಾಗಿರುವ ಗಣಿತದ ಪ್ರಮೇಯವು ಕ್ರಿ.ಪೂ. ಬೌಧಾಯನ ಶ್ರೌತಸೂತ್ರದಲ್ಲಿ
೬ನೆಯ ಶತಮಾನದಲ್ಲಿ ಅಂದರೆ Pythagorasನ ಜನ್ಮಕ್ಕಿಂತಲೂ ಮೊದಲೇ
ಬರುತ್ತದೆ. πr^2 ಎಂಬ ವೃತ್ತದ ವಿಸ್ತಾರವನ್ನು ಕಂಡುಹಿಡಿಯುವ ಕ್ರಮವು
ಶತಪಥ ಬ್ರಾಹ್ಮಣದಲ್ಲಿಯೇ ಬಂದಿದೆ. place value notation
ಅಂದರೆ ಏಕಸ್ಥಾನದಲ್ಲಿದ್ದ ೧ಕ್ಕೆ ೧ ಬೆಲೆ, ದಶಸ್ಥಾನದಲ್ಲಿದ್ದರೆ ಅದಕ್ಕೆ
ಹತ್ತರ ಬೆಲೆ ಹೀಗೆಯೇ ಸ್ಥಾನವನ್ನನುಸರಿಸಿ ಬೆಲೆಯನ್ನು ನಿಶ್ಚಯಿಸು-
ವುದು ಹಿಂದೂ ದೇಶದಲ್ಲಿಯೇ ಉತ್ಪತ್ತಿಯಾದುದು. ಶೂನ್ಯ ಶಬ್ದದ ಉಪ-
ಯೋಗವನ್ನು ಗಣಿತಶಾಸ್ತ್ರದಲ್ಲಿ ಮೊಟ್ಟಮೊದಲು ಮಾಡಿದವರು ನಮ್ಮ ಪೂರ್ವಜ-
ರು. ೫ನೇ ಶತಮಾನದಲ್ಲಿ ಆರ್ಯಭಟನು ಇದರ ಬೆಲೆಯನ್ನು ಉ-
ಪಯೋಗವನ್ನು ಅರಿತಿದ್ದನು. ಗಣಿತದ ಪ್ರತ್ಯೇಕ ಭಾಗವಾದ ಬೀಜಗ-
ಣಿತ ಗುಣೋತ್ತರ ಎಂದು ಇಂದಿನವರು ಕರೆಯುವ ಬಗೆಯನ್ನು
ಆಧಾರದಿಂದ ಒಂದು ವಸ್ತುವಿನ ಬೆಲೆಯು ಎಷ್ಟು ಆಗುತ್ತದೆಂದು
ಹೇಳುವನು. ಸಂಖ್ಯೆಗಳಲ್ಲಿ ಕೆಲವು ಸಮ, ಕೆಲವು ಅಸಮ ಎಂದು ಹೇ-
ಳಿ ವಿಂಗಡಿಸಿದ್ದರು. ಸಂಖ್ಯೆಗಳ ಅವಧಿಯನ್ನು 18 ಯಾ 19 ಸ್ಥಾನದವರೆ-
ಗೆ ಗುರುತಿಸಿದ ರೀತಿಯು ಇವರಿಗೇನೆ ಸಲ್ಲತಕ್ಕದ್ದು (ಅಂದರೆ 10 raised to
power of 18 or 19). ಗಣಿತಶಾಸ್ತ್ರದ ವ್ಯವಸಾಯವನ್ನು ವಿಶೇಷವಾಗಿ ಮಾಡಿ-
ದವರು ಜೈನರು; ಮೊಗಲ್ಲೆ ಪರಿಣಯಾಗಿ ಭಾರತ ವಿನಿ ವಿಶೇಷವಾಗಿ ಉಪ-
ಸ್ಥಿತಿಯಲ್ಲಿ ಸಾಲ್ವ ಜೈನ ಗ್ರಂಥಗಳಲ್ಲಿ ಈ ಮಾಯೋಗ ...

ರು. ಆ ನಾಲ್ಕು ಶಾಸ್ತ್ರಗಳಲ್ಲಿ ಗಣಿತ ಶಾಸ್ತ್ರ ಹಿರಿದೆಂದು ಗಣಿಸಿರುವರು. ಪಾಟಲೀಪು
ರದಲ್ಲಿ ಆರ್ಯಭಟನೂ ಉಜ್ಜಯಿನಿಯಲ್ಲಿ ಬ್ರಹ್ಮಗುಪ್ತ ಭಾಸ್ಕರರೂ, ಮೈಸೂರಿನ
ಲ್ಲಿ ಮಹಾವೀರಾಚಾರ್ಯರೂ ಗಣಿತ ಶಾಸ್ತ್ರವನ್ನು ಸಾಲಂಕೃತವಾಗಿ ಗ್ರಂಥರೂಪದಲ್ಲಿ ಪ್ರತಿಪಾದಿಸಿ
ನಮ್ಮ ದೇಶದ ಕೀರ್ತಿಗೆ ಆಧಾರಸ್ತಂಭರಾಗಿದ್ದಾರೆ. ಇವರ ದೃಷ್ಟಾಂತಗಳ ವೈಶಿಷ್ಟ್ಯ
ದಿಂದ ಪ್ರತಿಯೊಂದು ದೃಷ್ಟಾಂತವೂ ನಮ್ಮ ದೈನಂದಿನ ವ್ಯವಹಾರಕ್ಕೆ ಅತ್ಯಂತ ಉಪ
ಯುಕ್ತವಾಗಿ ನಮ್ಮ ಜೀವನವನ್ನೇ ಹಾಸುಹೊಕ್ಕಿದೆ. ಇನ್ನು ಪ್ರಾದೇಶಿಕದಲ್ಲಿ ಯಾವ ರೀತಿಯಲ್ಲಿ
ಉತ್ತಮ ಗಣಿತ ಶಾಸ್ತ್ರಗಳನ್ನು ಅವುಗಳ ರಚನೆಯನ್ನು ಪ್ರಯೋಜನವನ್ನು
ನಾವು ತಿಳಿಯಲಾರೆವು.

2/1 ಉದಾಹರಣೆಗಾಗಿ ಮಹಾವೀರನ ಗಣಿತಸಾರದಿಂದ ಪಂಚರಾಶಿ ವ್ಯವಹಾರ
೧೬ನೇ ಶ್ಲೋಕ - ಸ್ವರ್ಣದ್ವಯಂ ಗೃಹೀತ್ವಾ ತ್ರಿಮಾಸಾನಾಂ ಪ್ರತಿಮಾಸಂ ಸಾರ್ಧ ಸುವರ್ಣ

यः पुरुषः अष्टनार्यो तस्य कियद्भिर्तमानदिनैः 4374.

ಇದಕ್ಕೆ ಇವತ್ತಿನ ಗಣಿತದ ಪಾಠಕ್ರಮದಲ್ಲಿ Inter, BA class ನಲ್ಲಿ
ನಾವು ಕಲಿಯುವ ಎಲ್ಲ ವಿಧಾನ ಹೊಂದಿಲ್ಲ ಶ್ರೇಷ್ಠ ನಮ್ಮ ಜೀವನದಲ್ಲಿ
ಎಲ್ಲಿಯವರೆಗೂ ಉಪಯೋಗವಿದೆಯೆಂಬುದನ್ನು ನೋಡಬಹುದು. ಲೀಲಾವತಿ ಮಹಾ
ವೀರನ ಗಣಿತಸಾರಸಂಗ್ರಹದಲ್ಲಿ ಬಡ್ಡಿಯದ್ದೋ, ಸುವರ್ಣ ವ್ಯವಹಾರವೋ, ಕ್ಷೇತ್ರ ವ್ಯವಹಾರ
ವೋ, ವರ್ಗ ಘನ ಮೂಲ ವ್ಯವಹಾರವೋ ಉಪಯೋಗವಿದ್ದೇ ಇರುವದು.

ಭಿನ್ನ ಪ್ರತ್ಯುತ್ಪನ್ನ - ಸಂಖ್ಯಾ ಭಾಗನ ಲಬ್ಧಂ ಭವನಸ್ಯಾಂಶಂ ಪರಿಣಾಮ್ಯ
ತಿಸೃ ಪಾದ ಹೀನ ಭಾಗಸ್ಯ ಹೀನ ಪಾದಾಭ್ಯಾಂ.
ಶಲ ಗುಂಡಿಗೆ ಪ್ರಕಾರ 4/9 ನೇ ಭಾಗ ಕ್ರಯ ದ್ರವ್ಯ ಯಿಂದ 3/8 ನೇ ಲ
ಕ್ಕೆ ಎನು ಕ್ರಯ ಬಂದಿತು?
ವೃಷ್ಟಿಪಾತ ಉಂಟಾಯಿತು, ಅನುಷ್ಠಾನ ಹೊಮಿತ ಕ್ಷೇತ್ರಂ ಮಾಡಿ:
ಕಾರ್ಯಕ್ರಮ ವಿಲ್ಲ ಕದಂಬ ನಿಯಾಮಕ ಮೂಲ ಮಾನಃ
ಕನಕ ಭಾಗಬಿಂಬ ಪ್ರತಿಬಿಂಬ ರಾಶಿ ಹೀನಗತಿ ಚ
ಫಲ ಮನ್ಯಾಂತ್ರ ತತ್ತ್ವ ಲವರಯೋ ಗುರಿಯ ಗಣನಂ ಮಹಾವೀರ.
ಛಾಯಾ ಶ್ರೇಣಿ ಗಣಿತದಲ್ಲಿ ಸೂರ್ಯ ಮತ್ತು ನೆರಳಿನ ಉದ್ದವನ್ನು ಲೆಕ್ಕಿಸುತ್ತಿ ಇಂತಿಷ್ಟು

ಇವರ ಕಾವ್ಯಗಳಿಗೆ ಅನುಕೂಲವಾಗುವಂತೆ ಇವರು ಸಂಖ್ಯೆಗಳನ್ನು ಹೇಳುವ ಮಾ
ಟದ ಕ್ರಮವನ್ನು ರೂಢಿಸಿರುವರು. ಅಂದರೆ ಪ್ರತಿಯೊಂದು ಸಂಖ್ಯೆಗ
ಸಾಂಕೇತಿಕವಾದ ಹೆಸರೊಂದನ್ನು ಕಲ್ಪಿಸಿ, ಏಕಸ್ಥಾನದಿಂದಲೇ ಆರಂಭಿಸಿ ಸಂಖ್ಯೆ
ಯನ್ನು ನಿರ್ದೇಶಿಸುವರು. ಉದಾ: ಬೆಂಕಿ ಎಂದರೆ 3, ಚಂದ್ರನೆಂದರೆ 1, ಕಣ್ಣು ಎಂ [illegible]
2, ಆಕಾಶವೆಂದರೆ 0. ಹೀಗೆ ಚಂದ್ರ, ಕಣ್ಣು, ಆಕಾಶ ಮತ್ತು ಬೆಂಕಿ ಎಂದರೆ 302
ಎಂದರ್ಥ. ಈ ತೆರನ ಸಂಖ್ಯೆಗಳ ನಿರ್ದೇಶನವು [illegible]
[illegible]
[illegible] 430
[illegible]
[illegible]
ನು. ಒಂದನ್ನು ಇಲ್ಲಿ ಹೇಳುವೆವು. ಶ್ಲೋಕ: ನವ ಚತುರಸ್ತ್ರ [illegible]
[illegible]

The Aryan Path for August publishes a learned article on the Arya The Nobleman wherein the author mentions how the Buddha called himself an Arya or a Jina and contrasted the Arya with a 'dasyu' who is black and who does not lay any claim to spirituality. The emphasis there has been mainly on the Buddhistic connotation of the word while we wish to show that this contrast between the 'white' and the 'black' professions can be noted almost in every page of Samskrit Literature.

The white or the noble profession has been allegorically described by our Puranic poets as the Hamsapaksha as contrasted with the black or the Kakapaksha. Our Puranic poets loved to speak in lovely parables and created these two birds. The virtuous man was always compared to a swan and the capacity for separating milk from water which the bird is supposed to possess was availed of as a model lesson for the good man who was

advised similarly to appreciate only the Virtues and eschew the Vices of the men Coming into contact with him. The Sanskrit moralist Bhartri compared such men also to a coconut tree which remembers gratefully the water poured at its foot years ago and preserves water on its head, anxiously waiting to return its debt. Similarly the moralist Kalidasa asked the good man to imitate a tree which unselfishly receives all the heat of the sun on its head and provides not only shadow but fruits to the person that sits in its shade. On the Contrary, the wicked man is very often Compared with a Vile crow which always waits stealthily to snatch away some food however dirty it might be. By the way, it must be also noted that the 'hamsa' loves only to drink the sweetest and the most pure water of the Ganges alone: When the water happens to get brackish or shows a tendency to be muddy at the beginning of the monsoon, the swan passes through the Hamsadwara or an aperture through

the Krauncha mountain to the Manasasarovar on the other side where there is no Contamination of the water by the monsoon.

The Dronaparva of the Bharata epic has a lovely story to illustrate this Contrast. The crow brags about its so called powers and even boasts that it Can easily fly across the ocean while the silent swan listens without any Comment. It so happens that both the crow and the swan start on their journey across the sea together and the vile crow half way Comes to grief and falls; but the noble swan slowly manages to help the crow across and lands it safe on the other side of the ocean. Salya, the maternal uncle of the Pandava twins, remembers his promise to his nephews and when Duryodhana proposes to Salya to be a Charioteer to Karna in his ensuing fight with Arjuna, narrates this story Comparing Karna to a vile crow and Arjuna whose fame is as white as his name to the swan in the story. Similarly the Bhagavata Purana draws an

interesting contrast between a Vayasa tirtha and a Hamsa tirtha and declares that swans do not at all like to dwell in such Vayasa tirthas as they always like to dwell only in places which are ~~full~~ of resplendent with light; 'Ushikshargas'. In the context in question, it is emphatically asserted that the place where the Lord's glory is not enthusiastically sung is a vile place where only crows will breed.

This contrast between the crow and the swan can be traced in individual poets also. Kalidasa refers to this proverbial capacity of the swan drawing out only the milk and refusing the water in the context where he makes Dusyanta declare that his arrow will recognise the enemy to be killed and save the friend in distress. Bana the greatest prose writer has a beautiful passage in his Harshacharita III ucchvasa or chapter where the King Pushpabhuti, a remote ancestor of the poet's patron Sri Harsha the Emperor attacks a Naga or the snake, who pretends to be the spiritual overlord of the field in question and

challenges him saying: 'are kākodara kāka, mayi sthitē rājahamse na jihresi balim yācitum.' Here the ~~snake~~ Naga chieftain is supposed to possess a stomach as vile as that of a serpent. Over and above the contrast drawn between a crow and a royal swan (as the king compares himself with), there is another notable point here and that is the vile person is supposed to have a poisonous stomach and will always vomit poison only. The vile creeping serpent is another example for a vicious person and the moralist in Samskrit has another instructive verse comparing such person to a mosquito or a maśaka. This mosquito hovers round our feet (with a sinister purpose), bites our back, moves about our ~~ears~~ humming sweetly; after this it slowly feasts on our blood most unsuspiciously just as a vile person or a tale-bearer does.

The comparison of a vicious person to a crow is not peculiar to Samskrit alone. Even in English, the word crow has colloquially acquired such a very sinister significance. Even the word scarecrow actually refers

to an ugly effigy that is prominently hung up in a field say to scare away wild birds that might destroy the harvest.

The word Hamsa besides meaning swan has also acquired another noble connotation. It refers to a particular order of holy Yatis or Swamijees who happen to be the religious Pontiffs presiding over the Mathas. Some of these holy Swamijees are also Paramahamsas and not merely Hamsas. These are supposed to illuminate our spiritual path to Moksha. They are the torchbearers whose duty is to hold aloft the lamp of spiritual perfection. One such was the ancient Sage Vishwamitra whose very name means friend of humanity. It was he that taught us our Gayatri and qualified himself to be a universal friend. The word Hamsa also refers to the highest goal naturally therefore the word refers to the way and the goal of the Hindu pilgrim in his path towards perfection. No wonder therefore that the word refers to the noble path of spirituality

Even the person passing off inferior goods as superior is regarded as a thief and punishment is prescribed as for example by Dandaviveka of Vardhamāna. He says on p100 (Baroda Edition) 'cheaper medicines, oils, salts, sandalwood, grains and jaggery if passed off as of superior quality warrant punishment.' The goldsmith substituting inferior gold is referred to as sanakantakapāpiṣṭ on the next page. Similarly the person passing kastūri scent into black mud and labelling the same as Kastūri and marketing it, cat's skin properly coloured and passing off as tiger's skin, ordinary crystal coloured red and passing off as Padmarāga or ruby, coloured cotton thread marketed as silk thread, iron vessel coated with white marketed as silver, bilva wooden piece passed off as sandalwood by soaking it in sandalwood paste etc is to be punished, also the washerman wearing the clothes entrusted to him for wash, the person who on false pretext swindles money, who receives money for teaching any art but does not keep up the contract, merchants using false weights, doctors dragging on the treatment or

to exact more fees, persons posing as 'foretellers' only to deceive believing clients, regular thieves who bore a hole in the wall & commit burglary, pickpockets in broad daylight, persons waylaying travellers & demanding their goods with threats, kidnappers of men, women & children, persons decently dressed and parading bogus degrees or diplomas, persons lifting cattle are to be punished. Severe punishment was to be meted out to the 'pickpocket' who was called उत्क्षेपक 'lifter' or ग्रन्थिभेदक – 'knotbreaker' by Manu and Yajna-valkya who decreed that when caught redhanded for the first time, their fingers were to be cut, second time hands & legs to be cut, further repetition being summarily punished with death.

Laghu Bhaskariya of Bhaskara - Commentary by Shankaranarayana - published by the Curator, University Manuscripts Library, Trivandrum. Price Rs 1-8 o pages.

Reprinted from the Journal of the Trav. University oriental Mss. Library (T.S.S. No. 162) the ancient classic written by Bhaskara on Astronomy known as Laghu Bhaskariya has now been issued as an independent Volume and should convincingly demonstrate the truth that even without scientific appliances, instruments, & equipment that are today available to modern astronomers, ancient Indian astronomers had been able to make solid and substantial contributions to the world's stock of knowledge of the mysteries of terrestrial phenomena, movements of planets, eclipses & so forth.

The volume here noticed contains the text in Sanskrit & a commentary entitled Vivarana. In the course of a learned & scholarly introd - Mr P.K. Narayana Pillai has pointed out that ancient Indian astronomy had been enriched & expounded by two Bhaskaras. Bhaskara I flourished in the 6th Cen. while the second Bhaskara, the celebrated author of the Siddhantasiromani lived in the 12th Cen. Bhaskara I must have written 2 works

one a larger & more exhaustive version known as Brihadbhaskariya & the other an epitomised version and entitled it as Laghubhaskariya. The Commentary should have been written about 869 A.D. Mr Pillai has explained the historical significance of the work & come to the conclusion that king Ravivarma Kulashekhara & Shankaranarayana were contemporaries. It is interesting to note that Kulashekhara had an observatory which perhaps had been equipped as efficiently as was possible in those days.

Divided into 8 chapters, the main work deals with phenomena like solar & lunar transits, eclipses, transits of other planets, retrograde movement, & concomitant details.

Shankaranarayana's must be deemed a highly illuminating commentary. I would like to draw the attention of readers to an elaborate description given by Shankaranarayana of a complicated structure to be erected & appliance to be installed for the purpose of observing & measuring the shadows thrown by the sun (pp 35-36).

A careful study of the 4th & 5th chapters of the Bhaskariya would show occidental critics that centuries before the advent of modern occidental astronomy, the ancient Hin

Hindus had determined & understood all about the solar & lunar eclipses not merely, but had complete & perfectly accurate insight into minute & complicated astronomical phenomena particularly into the intricacies & technique of planetary transits.

A nice & subtle argument has been urged by the author Bhaskara to the effect that the movements & transits of other planets are correctly inferred from the data observationally collected on the basis of the transits & movements of the sun. It is highly significant that countless phenomena would have to be determined only by means of inference & inferential reasoning on the basis of foundational data that should be observational.

While Shankaranarayana extols Aryabhatta to the skies & boldly declares that his method is the best, (this is of course the judgment first proclaimed by Bhaskara), Brahmagupta severely condemns Aryabhatta & roundly observes that it would be impossible to count or make a list of his errors.

Nataraja Sarma.

pūrṇamadaḥ pūrṇamidam pūrṇātpūrṇamudachyate
pūrṇasya pūrṇamādāya pūrṇamevāvashishyate.
'Pūrṇa divided, multiplied, subtracted from and added to Pūrṇa yields only pūrṇa' – thus did our ancestors who composed the Upanishadic prayer equated God with pūrṇa or the Fourth Magnitude and postulated their mathematical problems long prior to the birth of Christ. Though Mathematics was not regarded as one of the four upavedas (Dhanur-Veda, Ayurveda, Gandharvaveda & Arthasastra), it was the study of Jyotisha among the Vedangas that gave a filip to this science; Jyotisha or astronomy was like the 'eye' and was helpful to one and all and more particularly in ascertaining auspicious moments for sacrifices. The circular, triangular or quadrilateral figures drawn in connection with the sacrifice again had to be taught in the Shulba sūtras and provided the needed impetus for the growth of Geometry. They had to observe the sky all night with instruments like Turīya and established famous observatories in Delhi, Benares, Jeypore, Ujjain & Lanka with their ~~imperfect~~ material (from the modern pt of view) equipment. They called it Science of Stars (Nakshatra Vidya) and gradually they saddled this knowledge with that of the panchangam – tithi, vāra, nakshatra, karana, yoga and slowly built up their astronomy.

Already in the 5th cen BC. in the list of the sciences in the Buddhist curriculum of studies ~~to study~~ according to the Buddhist scripture Mahavagga, Mathematics ~~was~~ occupied a prominent place. Another king Kharavela in 165 B in his stone inscription refers to computation of interest, to calculation of daily wages for coolies, and to the method of finding out the area of a quadrilateral. By Brahmagupta's time in the 7th cen AD, this science had not outgrown its connection with Astronomy and sometimes Mathematicians are left wondering whether Brahmagupta was a greater mathematician or an astronomer.
In Brahmagupta's time, astronomy was reckoned into a separate science and Mathematics came into its own with sections on kṣetra ganita, parikarmaganita, vyavaharaganita, rajjuganita, rashiganita, kalasavarnaganita (fractions), yāvattāvad-ganita (yāvattāvat = unknown x), Vargasamikarana, Arithmetic progression (mishradhana), ghanamūla = square root, indeterminate equation (aniśchitarthasamikarana) etc.
Pṛthūdakasvāmi the commentator in 9th cen included more subjects like panchagatiya five kinds of ~~~~, Vyasta trairasika (inverse rule of three), Saptarashi, ekadasharashi, Bhandaprati-bhānda (barter exchange). Dhulikarma & Pātiganita

were first introduced into Mathematics by Brahmagupta. Dhuli means dust, pāṭi signifies board; so this ~~means~~ refers to those problems that can be worked out on the board. In Arabia these were consequently called 'ilm hisab altakht'. So gradually through the moorish universities of Spain, these spread into Europe and Italian merchants popularised it all over Europe ~~in spite of papal decree~~. These are even known as liber abessey. Brahmagupta also knew that kuṭṭakāra (algebra) can easily solve all intricate problems and Bhaskara sponsored this branch with a new name as bija or avyaktaganita. This Brahmagupta is hailed as the author of two important works, Brahmagupta siddhānta and Khandakhādyaka. The latter teaches easy methods for calculating the latitude & longitude of planets according to Aryabhata's 'ardharātrika' method. Lanka was the Greenwich of those days & the daily movement of the planets, their positions etc at Lankā at midnight are recorded. This Brahmagupta should receive properly most of the credit that Bhaskara has received and later mathematicians like Mahavira, Sridhara and others unreservedly follow his lead. He has treated Geometry also fairly fully. Bhaskara might not have dealt with the

cyclic Quadrilateral but Brahmagupta has taught that the area of this cyclic quadrilateral is the square root of $(s-a)(s-b)(s-d)(s-c)$ if its 4 sides are a, b, c, d, s being half the circumference of the concerned circle. His example of arithmetic progression is worth quoting: 9 ~~people~~ merchants jointly invest 1, 2, 3 ... up to 9 rupees and sell the same again jointly for 495 rupees. What is each merchant's share. Answer is 11, 22, ... 99. Another interesting example is a long bamboo plant is broken in the wind and falls 6 cubits away. The broken bits are 8 and 10 cubits respectively. The value of these problems is patent to everybody. This Brahmagupta solved the indeterminate equation a full 1000 years before the westerners solved it in 17th cen as $ax^2+1 = by^2$. The value of π was mentioned as the square root of ten or 3.1416. Bhaskara and Mahavira followed him in this problem.

Mahavira flourished in the reign of Amoghavarsha Nrpatunga (814–877 A.D) in what is now Mysore State. His Ganitasarasangraha mentions 8 qualities as essential for a mathematician: capacity to choose easy methods, to guess if the method can solve, diligent application, capacity for quick comprehension and retention, to work out the problem by

other means, and last but not least a plan for apprehending unknown problems.

Sir William Jones, Hillton Webster, Prof Ball, Laplace and many other Orientalists have openly affirmed that these numbers are definitely of Indian origin. It is our misfortune if just because these Arabs happened to popularise them in the west, these should have become famous as the Arabic numbers. Al Biruni, the Arabian historian of about 1030 called them the most beautiful form of Indian figures and declares that problems very difficult to be performed with Roman numbers are easily solved with these Indian numbers. Arabic authors refer to them as Al Arqamul Hindiyyah. One can easily see how clumsy these Roman figures are: to write hundred they write C, 50 is expressed by L and 10 by X. 9 has to be written as X-I or IX. Multiplication or Division is absolutely impossible with them. These Arabians again introduced our decimals and Zero or cypher is so called because it is traced back to Arabic sifr. If Pythagoras (582 were born in) B.C. the theorem known now after him was already propounded in India in the 8th century in Baudhayana's Srautasutra. The formula πr^2

for working out the area of a circle was already worked out in the Śatapatha Brahmana. Place value notation, or the value of a digit being increased ten times if its place was pushed back by one place say from integer to ten, or from hundred to thousand & so on was the invention of the Hindus according to Laplace who handsomely concedes that this invention places the Hindus in the most honoured ranks of the mathematicians of the world; ~~since~~ even this invention ~~according to him~~ did not emanate from the brain of the most celebrated ~~scientists~~ Mathematicians of Greece, Archimedes (287-212 B.C.) and Apollonius. The value of zero again in increasing the value of a number to which it is added by ten times was another invention of the Hindus. They had classified them as odd and even long before the advent of the Xian era. The fame of having carried these numbers to as many as 18 or 19 places i.e. raising 10 to the power of 18 or 19 is again another creditable achievement of the Hindus. Jains, like Mahāvīra glorified this science to the highest possible extent by declaring that Mathematics was one of the four spiritual anuyogas which would lead the spiritual aspirant to his Maker.

Aryabhata in Pataliputra, Brahmagupta and

Bhaskara in Ujjain, Mahavira in Mysore and so many others in different places have earned everlasting fame by writing their mathematical poems. These poems are also highly valuable since they ~~...~~ satisfy the highest canons of critical dictum also. No other country in the world has treated this 'dry-as-dust' science in verse. Another speciality is that the examples they have cited are all having a direct bearing on our day-to-day problems in life. Some of them have taught the method of calculating the time of the day by measuring the number of steps in one's shadow. If they want to teach problems in square measure, the problems are those relating to building of our houses and boring of our wells or construction of walls, their length, breadth and width. The problems determine the circumference of the well. Is it not our duty to study these text books, written by our own ancestors who have deserved the admiration and applause of the world?

उत्तरकालामृतं - authorship of

शरीरमाद्यं खलु धर्मसाधनम् -

Predictive Astrology was nurtured on the lap of ~~[illegible]~~ [illegible]

tickled in the breast of man.

आत्मैक तोऽस्ता शिरवरं प्रतिरोधयतिनामा विकृतोऽफण पुरस्सर [illegible]

यथा ह्येकेन चक्रेण न रथस्य गतिर्भवेत् । एवं पुरुषकारेण विना दैवं न सिध्यति

This Combination between Purushakara & Daiva is the burden of

Kālidāsa's works and is the burden of our philosophy too.

अरक्षितं तिष्ठति दैवरक्षितं सुरक्षितं दैवहतं विनश्यति

लोके गुरुत्वं विपरीततां वा स्वचेष्टितान्येव नरं नयन्ति

Heaven waits always in readiness to reward the virtuous acts

of the people in the world. Mysterious are the ways of providence.

Pururavas' virtue was rewarded by heaven voluntarily dedicating

itself heart and soul in devoted service. The Gods in heaven are [illegible]

ready to properly reward human endeavour - प्रत्युपकृतं मरुद्भिः

प्रतिपत्त्या लघु मन्यते भवान् । [illegible] । [illegible]

but only they will put the devotion of man to a severe test and satisfy

themselves about its genuineness. Isvara reckoned himself as the fitting

reward for Parvati's sincere penance. उमोत्तीर्णं [illegible]

द्वीपादन्यस्मादपि मध्यादपि ।~ आनीय झटिति घटयति विधिरभिमतमभिमुखीभूतः

Though realising full well all these, the average Indian abjectly resigns himself

blindly to all powerful fate. The Ramayana epic uses the word दैव [illegible] in connection

[illegible] last for good

The fact that in [illegible] he shows no interest in the problems of life and destiny. (p 160 - Keith Sanskrit Drama)

Kalidasa and Vidhi Vilasa.

Kalidasa has been accused of not being helpful in any way in solving the problems of life and destiny by one of the greatest of the western sympathetic critics, Dr BERRIDALE Keith. Is this criticism just? We will try to shew that Kalidasa was a poet whose feet were firmly planted in the ground below him and taught humanity at large the proper way to live their life in this world fully so that we might deserve the rewards of this world and those of the next world also. The ordinary man, as a result of a mis-interpretation of our Vedanta, abjectly resigns himself almost blindly to fate and thinks with Shakespeare's King Lear "As flies to wanton boys are we to the gods, they kill us for their sport." The burden of our literature and philosophy, as reflected in Valmiki and Kalidasa the best interpreters thereof, is to show that there must be proper coordination between life and destiny.

Man exhibits a tendency to turn fatalist all the world over. Bhartrhari narrates an interesting story of a famished and dying snake — unable even to move — which luckily could eat a mouse and move out by the way that mouse had prepared for it, in its search for food! But this fatalism deprives us of our

initiative in every way. This represents one extreme view as against which there is the Greek view of Prometheus who believes he could overcome fate and make an end of all suffering. "There is a natural fire in man which declines to accept defeat. In this fire fanned by the poet till it flames, is the secret of our delight in a tragic drama'. Both these extreme views have their counterparts in Indian philosophy, Karna, Kamsa, Duryodhana tried in vain to circumvent fate and the golden mean between the two is the correct attitude advocated by Vedanta. The Hitopadesa sloka admirably sums up this view अरक्षितं तिष्ठति दैवरक्षितं सुरक्षितं दैवहतं विनश्यति। जीवत्यनाथोऽपि वने विसर्जितः कृतप्रयत्नोऽपि गृहे न जीवति "Though world forsaken, something protected by God survives: though well-protected, a thing might perish if forsaken by God: A destitute in the forest may thrive while the best protected in the house may succumb. To change the metaphor, divine dispensation and human effort are like 2 wheels of the same chariot; properly coordinated human progress must be secured only with the grace of divinity. When correctly understood, divinity or destiny is nothing but the manifestation of our own actions in our previous lives according to the testimony of Yajnavalkya.
1, 9 et seq
In other words, we make or mar our own destiny, we are the architects of our own fortunes and we have to blame ourselves

on the world, [illegible] our efforts go awry
. to be successful, but decry fate when by some mischance
if in any particular case, our plans miscarry, The Emperor drama Sri Harsha gives us a remarkable sloka in which he declares that destiny will even go out of its way to help us if we look up always to it.

द्वीपादन्यस्मादपि मध्यादपि जलनिधेर्दिशोऽप्यन्तात्
आनीय झटिति विधिरभिमतमभिमुखीभूत: Ratnavali I.

even from another Continent, even from the middle of an ocean, nay from even the ends of the quarters, destiny - if only ~~it is~~ made favourable - ~~destiny brings about the~~ unites one ~~lover~~ with another ~~quite most~~ unexpectedly ~~way~~. The problem of Prometheus is there in every age and clime and for every person, with a divine origin, actuated by a humanitarian motive, he brings fire to the earth; an adverse fate drags him bound in chain in the beginning but in the end he regains his freedom through his own efforts. This is also the ~~sum~~ and substance of our Vedanta which also declares that all men possess divine sparks and characteristics though not knowing how to make proper use of them. Shelley also teaches us to face destiny boldly and squarely, though never defiantly. Man must ride and God must hold the reins. The Latin proverb nisi Dominus frustra, unless the Lord buildeth, those that labour build in vain, correctly understood ~~emphasises~~ this same truth.

Our two epics exhibit the two sides of this universal moral coin which never becomes uncurrent with changing ~~empires~~ governments and times. With the mightiest army and the best generals of the day, Duryodhana defied fate since in Its personified form as Sri Krishna had leagued Himself with the Pandavas. With monkeys and bears of the subhuman kingdom as his allies, Rāma managed to defeat the mightiest king with the mightiest superman (but āsurasampat) entrenched in a most impregnable sea island fort. The central message in Kālidāsa's works is also the same: to quote his sloka in the central act (IV verse) of the Sakuntala: यात्येकतोऽस्तशिखरं पतिरोषधीनां etc. Chandra the Lord of the most potent medicinal herbs, some of which can revive even dead persons, has to go himself to the setting mountain in the west; the sun but imperfectly equipped with a legless charioteer and a onelegged chariot rises up at the same time in the sky! This proper coordination between purusakara or human effort blessed by daiva or destiny is suggested in every work of this kavisarvabhauma. Heaven always waits in readiness to reward the virtuous actions of man in this world. Pururavas' virtue was rewarded by heaven (in Urvasi's guise) voluntarily dedicating itself heart and soul in his devoted service. Heaven typified by Urvasi has become dignified: it must come to the earth to karmabhumi to meet its haven. The gods in heaven are too

ready to properly reward human endeavour - प्रथमोपकृतं मरुत्वता Sāk VII.1 but only they will put the devotion of man to the severest test and satisfy themselves about its genuineness first. Isvara reckoned Himself only as the fitting reward for Parvati's sincere devotion (typifying well-directed human effort; when misguided by Kāma, it was abjectly rejected.) - Māgha emphasised this coordination when he declared in II 86. नालम्बते दैष्टिकतां न निषीदति पौरुषे । शब्दार्थौ सत्कविरिव द्वयं विद्वानपेक्षते ॥. Sri Harsa the poet also declared similarly that when destiny is averse, human effort finds itself frustrated - दैवे निरुन्धति नि[illegible] हन्त प्रयास परुषाणि नु पौरुषाणि 11.55. The Aitareya Brahmana had long ago proclaimed this truth when it taught आस्ते भग आसीनस्योर्ध्वं तिष्ठति तिष्ठतः शेते निपद्यमानस्य चरति चरतो भगः. Our philosophers might disagree sharply on hair-splitting, quibbling all other technical & philosophic details, but on this essential point, all of them wonderfully agree. Sri Samkara in his Bhajagovinda dedicated himself for divine service; Vedanta Desika sincerely prayed न्यस्य त्वत्पादपद्मे निजभरमनुकं निर्भरं निर्भयोऽस्मि and Madhva in his Dvadasastotra advised us कुरु भुंक्ष्व च कर्म निजं नियतं हरिपादविनम्रधिया सततं, to do the right thing trusting in God.

Perhaps Keith was worried by not finding any tragedy of the type of Othello or Hamlet in Sanskrit literature. The theory of transmigration and the law of karma which has become ingrained in the Indian soil for many millennium now, preclude the possibility of the conception of such tragedies. The very conception of literature is completely different from the realistic outlook sponsored in the west. Our literature has got to reflect the ideas and ideals of our religion and can never afford to stop with the contemporary world around us. Virtue or vice must have its just reward if not today in this life, at least in the next life. Our life now is the result of a past and is itself the cause of a future existence to be determined or shaped by the present. If a Hamlet were conceived or nurtured in an Indian brain, it would have completely altered the story by either introducing some Teacher to advise him properly or by rejuvenating the old Hamlet with the aid of supernatural elements. The genius of the Indian poets and dramatists lay in the fact that they managed their plots dexterously even though tragedies were forbidden: the tragic ending was carefully avoided, but the poet cleverly saw to it that the letter of the law was satisfied by achieving tragedy and at the close, but

Human free will should be coupled with timely interference by the Divine into the affairs of humanity with a view to make it progressively better. The Gita has made it quite clear that such interference is gradual & even persistent, the agents in fact being no other than i) the small unsuppressible voice of God within us, ii) the lessons available to humanity in the world's school of experience to which we all have to submit (iii) the guidance by precept and example by the better types of men, whom the Gita designates विभूति that are carrying out God's will on earth in ways more than one. Avatara in fact is the name that human piety gives to the most outstanding & unusually successful from amongst the Vibhutis above named.

throughout tragic situations were introduced at every stage. Who can deny that Sakuntala's repudiation in the V act is a tragedy? The mainsprings of our literature, the two immortal epics were the most heartrending tragedies, in fact the earliest of the most thoroughgoing tragedies the world has ever produced; if Kalidasa, Bana, Sri Harsa and Bhavabhuti managed to convert their tragedies into comedies with supernatural devices, Bhāsa in his Svapnavasavadatta skilfully managed this change without the least supernatural aid.

How and why does this supernatural aid come in? Valmiki answers [illegible]. It may appear as though it is a quite fortuitous circumstance; really it has an inner purpose: ~~but~~ the Vedānta philosophy suggests the only satisfactory solution when it declares that this is but the just reward deserved by our actions in our past lives. A kind and just God waits at the corner as a seemingly disinterested sākṣi, allowing every one of us a sporting chance to work our way up to Him from whose feet we have come and to whose feet again ultimately we are bound. If necessary and expedient, God even lends His helping hand in His merciful bounty; our duty is to deserve and desire for His grace. The Vedānta philosophy amply emphasises the importance of a Guru who directs our attention inward. तमेव शरणं गच्छ सर्वभावेन भारत। तत्प्रसादात्परां शान्तिं स्थानं प्राप्स्यसि शाश्वतम्. Such Gurus

Visvamitras' or friends of humanity are there always and we will be fortunate if we recognise them. But their ways are mysterious and there is no knowing when they will come. Rāma in the Ramayana meets with 2 of them Visvāmitra and Hanuman at most critical moments and derives the utmost benefit from them. A third Ṛṣyaśṛṅga ~~met~~ Dasaratha & was responsible for securing Rama. But evil geniuses with wonderful potentialities for mischief also cross our path, as यदृच्छया or most unexpectedly ~~also~~ too; Mantharā and Sūrpaṇakhā do so and all these four, it is interesting to note, cross Rama's path यदृच्छया. Vālmiki uses the word यदृच्छया often in connection with these 5 personalities. As regards the second version, Murāri in his Anargharāghava declares यान्ति न्यायप्रवृत्तस्य तिर्यञ्चोऽपि सहायताम् अपन्थानं तु गच्छन्तं सोदरोऽपि विमुञ्चति, that even beings of the sub-human species come to the aid of a righteous person (Rama); even the brother (Vibhisana) deserts the person (Rāvaṇa) treading the unrighteous path.

Kālidāsa refers to such Visvamitras who unbidden come to the rescue of forsaken humanity. Kaṇva rescues the baby forsaken by her parents and protected by Sakunta birds. Valmiki hears the cry of Sita in despair and protects her just as his heart had melted in sympathy with the bird shot by the niṣāda. Though divine, Kaṇva in the

Śākuntala I act cannot divine exactly how adverse destiny will overtake her and land her in peril. He was away on pilgrimage to avert her प्रतिकूल दैव, but दैव chose that very occasion to throw her into Duṣyanta's arms. Fortunately the आहुति fell into the पावक though the यजमान was धूमाकुलित-दृष्टि; but before the यजमान could return, before even Duṣyanta could reach his capital in 1½ days' time, the man of evil destiny Durvasas crossed her path and the order to escort her to the palace was not even uttered and Sakuntala was clean forgotten. To add to her cup of misery, Kaṇva happened to return on a Pūrṇimā night. The next morning on which he sent her to her husband's, happened to be the first day (प्रतिपदा) in the dark fortnight, most inauspicious for starting on a journey and she was unwittingly sent to her doom. But fortunately for her, in a most mysterious way, the lost ring was swallowed by a fish and a fisherman's research unexpectedly came to her rescue. She was remembered but Dusyanta was at his wits' end and he cursed himself for having driven Sakuntala to her destruction. But the most pleasant surprise awaits him; he is lifted up to heaven to be reunited with his child and wife!

Trust in God, tread the righteous path and allow heaven's light to be your guide. Never neglect your legitimate comforts - [illegible] - All will be well with you - this is the moral

[illegible]

Bernier (1656-1668) mentions the method by which poison can be conveyed in a betel chew. A young nobleman by name Nazerkan was suspected by the Mogul of an illicit love affair. As a mark of distinguished favour the King presented the betel in the presence of the whole court, to the unsuspecting youth, which he was obliged immediately to masticate, agreeably to the custom of the country. Little did the unhappy lover imagine that he had received poison from the hand of the smiling monarch, but indulging in dreams of future bliss, he withdrew from the palace, and ascended his paleky. Such however was the activity of the poison, that he died before he could reach home.

Suśruta (अन्नपानविधि) - to control phlegm which increases after ... the intelligent eater should partake fruits of an astringent, pungent or bitter taste or by chewing a betel-leaf prepared with broken areca, camphor, nutmeg, clove etc or by smoking. वराहमिहिर says: Brhatsamhita chap 77 गंधयुक्ति - कामं प्रदीपयति रूपमभिव्यनक्ति सौभाग्यमावहति वक्त्रसुगन्धितां च। ऊर्जं करोति कफजांश्च निहन्ति रोगान् ताम्बूलमेवमपरांश्च गुणान् करोति॥ युक्तेन चूर्णेन करोति रागं रागक्षयं पूगफलातिरिक्तम्। चूर्णाधिकं वक्त्रविगन्धकारी पत्राधिकं साधु करोति गन्धम्॥ ७७,३४ पत्राधिकं निशि हितं सफलं दिवा च प्रोक्तान्यथाकरणमस्य विडम्बनैव। कक्कोलपूगलवलीफलपारिजातैरामोदितं मदनमुदा मुदितः करोति॥. Alberuni says 'the power of digestion is so weak that the Hindus must strengthen it by eating the leaves of betel after dinner & chewing betel nut. The hot betel leaf drives out ... wet & betelnut acts as an astringent on the teeth, the gums & the stomach. (India Ch. 68. p. 15

Gardiner says that arecanut corrects the bitterness of betel leaf & chunam prevent it from heating the stomach. United they possess an extremely wholesome, nutritious & exhilarating quality.

ಹಂಸಪಕ್ಷಿಯೂ ಆ ಕಾಗೆಪಕ್ಷಿಯೂ.

ನಮ್ಮ ಪೌರಾಣಿಕ ವಿಷಯ ಉತ್ಪ್ರೇಕ್ಷೆ ಪ್ರಿಯರಾಗಿ ಆಧ್ಯಾತ್ಮಿಕ ಸಾಧನೆಯ ಕ್ಕೆ ಆದರಿಸುವರು. ಉತ್ತಮ ಮನುಷ್ಯರು ಹಂಸಗಳಂತೆ ಇರುವರು, ಖಲರು ಕಾಗೆಪಕ್ಷಿಯಂತೆ ಸ್ವಾರ್ಥಿಗಳೆಂದು ನೀಚ [illegible] ಸುವರು. ಉತ್ತಮ ಮನುಷ್ಯನಿಗೆ ಆದರ್ಶಭೂತನಾದ ಪರಮಾತ್ಮನೇ ಯೋಗಿಗಳ ಧ್ಯಾನ ಮನನದ [illegible] ದಲ್ಲಿ ಕಾಣಿಸುವ ಹಂಸನೆಂದು ಅನೇಕ ಕತೆಗಳಲ್ಲಿ ಉತ್ಪ್ರೇಕ್ಷಿಸಿ ಪರಮಾತ್ಮನನ್ನೇ ಹಂಸನೆಂದು ನಿರ್ದೇಶಿಸಿರುವರು. ಖಲರನ್ನು ಕಾಗೆಗಳಿಗೆ ಕಾಲನ ಪಾಶಗಳಿಗೆ ಹೋಲಿಸಿ, ಪರಮಾತ್ಮನನ್ನು ಕಾಲಿಯದಮನ ಶ್ರೀ ಮಹಾತ್ಮನೆಂದು ಹೊಗಳುವರು. ಜ್ಞಾನಮೂರ್ತಿಯಾದ ಪರಮಾತ್ಮನನ್ನು ಹಂಸನೆಂದೂ ಕರೆಯುವರು. ಈ ಹಂಸಪಕ್ಷಿ ಹಾಲನ್ನು ನೀರಿನಲ್ಲಿ ಬೆರೆಸಿದಾಗ, ಹಾಲನ್ನು ಮಾತ್ರ ಎಳೆದುಕೊಂಡು ನೀರನ್ನು ಬಿಟ್ಟು ಬಿಡುವ ಉತ್ತಮವಾದ ಗುಣವನ್ನು ಕಲ್ಪಿಸಿ ಉತ್ತಮ ಜನರು ಇದರಂತೆಯೇ ಸಜ್ಜನ ಗುಣಗಳನ್ನೇ [illegible] ದು ಪೋಷಿಸುವರು.

or whether it is the result of seeds planted, or accidentally left, by natives who have long since departed from the region in question leaving no trace of their former presence. Thus in the Phillipine there is a variety of Areca catechu known as silvatica as well as several other varieties, which has led botanists to think that the wild plant originated here. 'Any species of areca is not to be found in Southern or Eastern Asia or Malaya which in any way approaches Areca Catechu in specific character, whereas in the Phillipines an entire group of species closely related to it exists.' - Beccari - Palms of the Phillipine islands, Phillipine Journal Science Vol. XIV p. 301. Mr Merrill says there itself 'At the place where found the plants few in number were growing in a forested ravine along a small stream at a place where an old & apparently much travelled native trail crossed the stream. I strongly suspect that the trees I found in that place originated from seeds accidentally left there by natives.' N.M. Penzer is tempted to believe that if this custom did not originate on the coasts of Southern India, it was imported from the Eastern Archipelago at a very early date. Prior to about 200 B.C, both in the Jātakas & in several Pāli works (Buddhaghosa's Visuddhimagga 314, & Dhammapadaatthakathā Vol XXX. p. 49) as well as in the

Jaina scriptures Aupapātikā Sūtra section 38), this habit of betelchewing is referred to. The ताम्बूल करङ्कवाहिनी is an important functionary in royal courts & is referred to even in inscriptions - Epigraphica Indica Vol xi p329 etc. Hitopadesa Book III fab ix & xii. tells that it possesses 13 qualities hardly to be found in the regions of heaven. It is described as pungent, bitter, spicy, sweet, expelling wind, removing phlegm, killing worms & subduing bad smells. It beautifies the mouth, removes impurities & induces to love. Susruta mentions it, in the 1st cen. AD. In chap xlvi in a section on digestion he says that the intelligent eater should partake of some fruit of an astringent, pungent or bitter taste, or chew a betel leaf prepared with broken areca nuts, camphor, nutmeg, clove etc. By Kumaradeva's time the custom was so common that reference to it was practically given up. Abd Allah ibn Ahmad (1225) refers to the leaves being preserved in honey. He says Indians use it after their meal (instead of wine) to brighten their minds & drive away their cares. Marco Polo (1295 AD) refers to a strange custom in which if anybody wishes to offer a gross insult to another, when he meets him he spits this leaf or its juice in his face. After this the other immediately before the king, relates the insult, and demands leave to fight him. The king supplies the arms, the sword & the target, and all the people flock to see & the two fight till one of them is killed. The using of the point of the sword is forbidden by the king

camphor was a wrong translation for quicklime. Garcia
orta says "In chewing betre they mix areca with it and
lime. Some add licio (= catechu) but the rich & the grand
add some Borneo Camphor & some lign-aloes, musk and
ambergris." Yule correctly quotes Abul Fazl (1596) as sta
that Camphor is an ingredient of pānsupāri. कपूर [illegible]
the Bombay vernacular Piper chaba commonly known a
Bakek. Ridley says it can be used as a substitute fo
betel leaves during journeys if fresh leaves may not
procurable. देवकुसु, is cravo, caryophyllus aromatic
Jātiphala is nutmeg & पूग is of course arecanut - पू
Others mention these five as (1) Cutch = extract of Cat
- Hindustani Kat, Kath, Sanskrit खदिर. (2) चूना - lime =
3) सुपारि (4) Lavanga (5) Ilāchi [illegible].
The Singhalese chew the rhizomes of A. masticatoriu
with their betel.

The geographical area covered by this custom no
lies between longitude 60° & 170° east & latitude 40° no
and 15° South. It includes India, Pakistan, Southern Tibe
Southern China, Siam, Indo china, Malaya, all the

Indian Archipelago, Micronesia, New Guinea, and the remainder of Malanesia as far as the tiny island of Tikopia. It is just about here that one can observe the drinking of Kawa taking the place of betel chewing. In both Polynesia & Australia pānsupāri can be regarded as unknown. Although arecanuts have been exported to Fiji, & possibly to other islands, betel chewing rarely occurs in kava-drinking areas.

It is impossible to say where this custom originated. Ethnological evidence seems to favour an Austroasiatic, rather than an Indo Aryan home. Perhaps we should look for its origin in the Phillippines, Celebes, Borneo, Java or Sumatra. Botanical evidence is very noncommittal and uncertain, owing largely to the length of time the Areca Catechu & Piper Betle have been cultivated in the East. The former has been described as a native of Cambodia and Indonesia & as being cultivated in the East. The latter has been described in Watt (op. cit Vol vi, pt 1, p 248) as probably a 'native of Java'. The evidence for such statements seems to be distinctly weak. The problem is increased by the fact that it is often hard to determine whether a certain tree or a shrub is really 'native'

have been derived. Tamil pākku Telugu pōka. Vakka or ...
Vakka; Singhalese puvak or puvakka; Gujerati phophal ...
leads to Persian & Baluchistan pōpal & Arabic faufal, fōfal, ...
The word areca is to be traced to Kannada aḍake or aḍike ...
aḍakka or aḍekka.

Pān is the leaf and supāri is nut in Hindi and other North ...
Vernaculars. The latter sometimes changes into supyāri, sopāri ...
hopāri etc. With regard to Piper betle, tāmbūla or nāgavalli ...
in the Vernaculars. The more usual term is pān from which ...
pann = leaf is derived. Malayalam vettila (verru + ila = simple ...
is also used. In Hindustani, we find pān & tāmbūlā, in Bengali ...
in Marathi viḍe-chā-pān; in Gujarati pān, nāgher-vel; in ...
pān; in Tamil vettilai. Arabic tanbōl, Persian tambōl, ...
The portuguese favoured derivative of vettila which became ...
and betle. From this the English betel is traced - 16th cen spelling ...
betola, bettle, and bettele; 17th cen spelling betele, betell, bet...
vetre, bettaile, bettle, and betel; 18th & 19th centuries betle, beetl...
betelle & betel. In tāmbūla, root word is būla with tam as a ...
Przyluski has shewn that būla corresponds to the Austroasi...
(non Indo Aryan) bālu = something rolled; all Austro Asia...

languages use such words as balu, mluw, bölön, mĕlu, blu, plu, to mean betel. Some have a prefix such as la-mlu, ja-blu. In modern times, it is only the direct Sanskrit derivatives that keep the prefix.

Somadeva speaks of the five fruits flavouring arecanut, or lots of leaves of betel together with Camphor & the five fruits. The best list is arecanut, cloves, lign. aloes, ambergris (a fragrant substance, ash grey, floating on sea) and catechu. Of these only the first could possibly be called a fruit, — cloves are only flower buds. Lign aloes seems to have been used very rarely, while ~~[illegible]~~ ambergris would have been entirely restricted to the rich. We must allow fruit to include every kind of spice or flavour. Vaidyaka Sabda sindhu, a Hindu medical dictionary under the word पञ्चसौगन्धिक used in betel chewing mentions them as कर्पूर (2) कङ्कोल (3) लवङ्ग, जातीफल, पूग. कर्पूर is also referred to as चन्द्र भस्म, referring to its moonlike coolness. It was corrupted into कापूर, कपीत, and are traceable to the Sumatran Camphor tree, gābū or gāmbū whence Indian supplies were derived. Marco Polo mentions camphor & other aromatic spices in connection with betel chewing. Marsden expressed his opinion that

Tambūla.

The comparative lack of interest which this custom has stimulated in the west is really surprising. Over a 100 millions of the human race, but entirely in India and Farther India, Malaya and Indonesia, have taken to this as a daily, hourly or even more frequent habit! From his marriage or even far earlier to his grave, even to accompany him into the next world, this leaf does devoted service.

The seed of the areca catechu is used along with this. The expressions betel nut or betel nut palm are incorrect. pān-supārī is the chew of this nut with a pinch of lime wrapp[ed] round by the leaf. In Samskrit the usual word for this leaf is tāmbūla, but if the leaf is particularly mentioned the word nāgavallī is employed especially by Somadeva. He uses the form[er] word in all cases except in the context in which Jayadatta's son (Madirāvatī Book XIII Chap CIV) where Nāgavallī means leaves of the betel & 2 or 3 lines later tāmbūla is the chew which th[e] young Brahman puts in his mouth. The usual Samskrit words for the nut - pūgaphalam & guvāka - do not occur in Katha-saritsāgara at all. It is from the former of these that the Vernac[ular]

18-7-47. (1) A magnet is 10 C.M.S long. Making an angle 60° with the magnet draw a line thro the centre O. Take a point distant 15 C.M.S from O along this line. By a graphical method find the resultant field at P, the pole strength of the magnet being 20 units.

Draw SN 10 C.M.S. Draw OP making an angle of 60° with OS and OP = 15 C.M.S.

To find the resultant at P.

Measure PN and PS.

The force on N acts in the direction NP and the force S at S acts in the direction PS.

60°

S .... 10 C.M.S .... N

Represent $\frac{m}{PN^2}$ and $\frac{m}{PS^2}$ by PQ and PR.

complete the □ PRQ

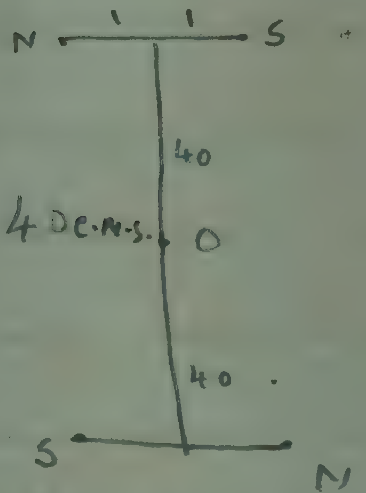
Intensity at the pt P on N = $\frac{m}{NP^2} = \frac{20}{13.3^2} = .1$

" " " " P on S = $\frac{m}{SP^2} = \frac{20}{18.3^2} = .05$

Resultant = .6.

(8) The length of the magnet = 2 c.M.S

$2l = 2$ c.M.S.



Distance of the pt from the magnet - 40 c.M.S.

Here l is very small when compared to D.

So we can use the formula $\frac{M}{d^3}$ for intensity

1st magnet. $M_1 = 2 \times m \times l = 2 \times 15 \times 1$.

Pole strength in one magnet = 15, and in the other = 2[illegible]

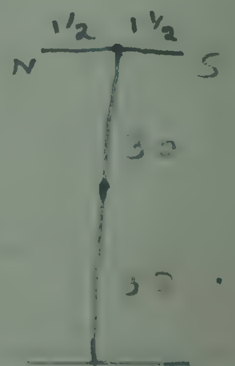
2nd magnet. $M_2 = 2 \times m \times l = 2 \times 10 \times 1$.

Resultant = $\frac{2M_1}{d^3} - \frac{M_2}{d^3} = \frac{2 \times 15}{d^3} - \frac{2 \times 10}{d^3}$

$= \frac{2}{40^3}(15 - 10) = \frac{2 \times 5}{40 \times 40 \times 40} = \frac{10}{40 \times 40 \times 40} = \frac{1}{6400} = .0$[illegible]

9 Length of each magnet = 3 c.M.S.

$\therefore l = \frac{3}{2}$.



Here also l is very small when compared to d.

$\therefore$ we can use the formula $\frac{M}{d^3}$ for intensity

Let M_1 be the moment of the 1st and M_2 be of the 2nd.

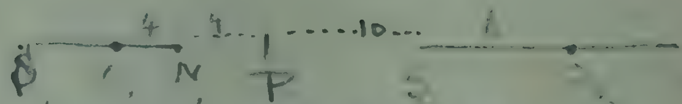
Resultant intensity $= \frac{M_1}{d^3} - \frac{M_2}{d^3} = \frac{2 \times m \times l}{d^3} - \frac{2 \times m_1 \times l}{d^3}$

$= \frac{2 \times 20}{30^3} - \frac{2 \times 15}{30^3} = \frac{2}{30^3}(20-15) = \frac{2 \times 5}{30 \times 30 \times 30} = \frac{1}{180}$

$= .00056$ gauss.

(10) The compass needle will show no deflection at a point where the intensity is zero.

Let the point be P.



Distance of the pt P from C_1 the centre of the small magnet $= 4+4 = 8$ C.M.S.

Distance of the pt P from C_2 the centre of the bigger magnet $= 10 + 4 + 2 = 16$ C.M.S.

Intensity at the pt $P = 0$.

Intensity at the point P on the small magnet.

$= \frac{2 \times m \times 2l \times d}{(d^2 - l^2)^2} = \frac{m \times 8 \times 2 \times 8}{(8^2 - 4^2)^2} = \frac{128m}{(64-16)^2} = \frac{128}{48^2}m$

$= \frac{8m}{3 \times 48 \times 6} = \frac{1}{18}m$. where m is the strength of the pole.

Intensity at the point on the larger magnet

$$= \frac{2 \times 2m_1 l \times d}{(d^2 - l^2)^2} = \frac{2 \times m_1 \times 12 \times 16}{(16^2 - 6^2)^2} = \frac{24 \times 16 m_1}{(256 - 36)^2} =$$

$$\frac{16 \times 24\, m_1}{220^2} = \frac{4 \cancel{16} \times 24 \times m_1}{\cancel{220} \times \cancel{220}} = \frac{24}{\cancel{2}55^2} m_1$$
(55 55)

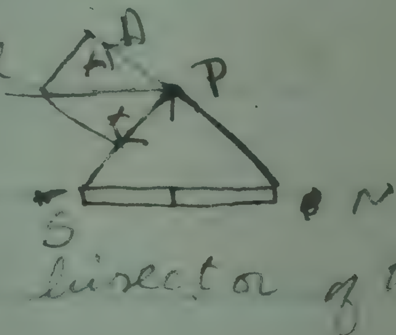
$$= \frac{24}{3025} m_1 \text{, where } m_1 \text{ is}$$

strength of the magnetic pole.

The ratio of the strengths $= \frac{1}{18} : \frac{24}{3025}$

$$= \frac{18}{18} : \frac{432}{3025} = 1 : .143 \text{ Ans.}$$

(11) Intensity at a point horizontal vertical to the magnet and the point is in the perpendicular bisector of the magnet. H = .377.

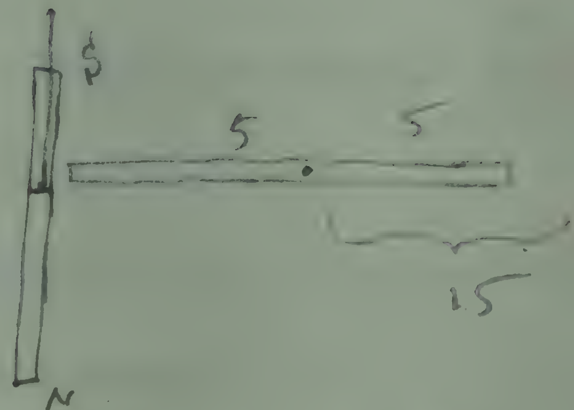


The direction due to N.P is PA.

The direction due to SP is PS.

The direction of the resultant is the diagonal through P.

(2) The moment of the magnet = M = 500.



m = pole strength = 50.

d = 15 C.M.S.

Resultant horizontal field strength at the point 15 C.M.S from the mid-pt of bar.

$$\frac{2Md}{(d^2-l^2)^2} = \frac{2 \times 500 \times 15}{(15^2-5^2)^2} = \frac{2 \times 500 \times 15}{(225-25)^2} = \frac{2 \times 50[illegible]}{20[illegible]^2}$$

$2ml = M = 500$. $\quad l = \frac{500}{2 \times 50} = 5$.

$m = 50$.

$$\frac{2 \times 500 \times 15}{200 \times 200} = \frac{3}{8}. \text{ Gauss} = .375 \text{ gauss}.$$

(40)

Horizontal Component of the earth's magnetic field } = .380 gauss

Resultant horizontal field strength = .755 Gauss

25.7.47. (4) The pole strength = 25.



Moment of the magnet = 250.

∴ The length of the magnet = 10.

use the formula. $\frac{M}{d^3} = H$.

$\frac{250}{10^3} = H$. $\quad H = \frac{250}{1000} = .25$ (Gauss)

(16) Moment of the magnet = 1000.

This is a small magnet.

∴ Formula $\frac{2M}{d^3} = H$.

$\frac{2 \times 1000}{d^3} = .38$.

$.38 d^3 = 2000$.

$d^3 = \frac{2000 \times 100}{38} = \frac{200000}{38}$.

$d = \sqrt[3]{\frac{200000}{38}} = \sqrt[3]{5263.2} = 17.4$ c.m.s

$\frac{1}{3} \times \log 5263.2 = \frac{1}{3} \times 3.7212 = 1.2404$.

Antilog of 1.2404 = 17.40.

∴ $d = 17.4$ C.M.S Ans.

(22) Here it is given that

$2l = 10$, $d = 8$, $H = .38$.

$\frac{M}{(d^2+l^2)^{3/2}} = H$.

$\frac{M}{(64+25)^{3/2}} = .38$.

$M = .38 \times 89^{3/2}$

$= .38 \times 839.7$.

$= 319.2$.

$2l = 10$.

$2\ m\ l = 319.2$

$m = \frac{319.2}{10} = 31.92$ Ans

N

S.

1.949

1.747

9.94 ×3/2

= 4.241

log 89 = 1.9494

0.9747

1.9494 × 3/2 = 2.9241

Anti log 2.9241

= 839.7

3) It is placed with the north pole pointing north.

$\therefore \frac{M}{(d^2+l^2)^{3/2}} = H.$

N

$H = .36$. Distance between the poles $2l$ = 20 cm. Distance of one of the neutral points from the centre of the magnet $r = 20$ cm. $l = 10$.

$M = H \cdot (d^2+l^2)^{3/2}$

$.36 = \sim\!\!\!\sim (400+100)^{3/2} = .36 \times 500^{3/2}$

$= .36 \times 11180 = 4024.80$.

$2ml = 4024.8$.

C.G.S. unit

m = The pole strength $= \frac{4024.8}{20} = 201.2$

4) The north pole is pointing north.

N

$\therefore \frac{M}{(d^2+l^2)^{3/2}} = H.$

S.

$2l = 20$. $d = 15$. $H = .37$.

$M = H \cdot (d^2+l^2)^{3/2}$

$= .37 (225+100)^{3/2} = .37 \times 325^{3/2}$

$= .37 \times 5859 = 2167.83$. C.G.S. unit.

The moment of the magnet: 2168 C.G.S. unit

Ans.

1-8-41

(27) The moment of the magnet = 180 C.G.S units.

In End on arrangement it produces a deflection of 45°.

$$\frac{M}{H} = \frac{d^3}{2} \tan\theta. \quad \frac{180}{H} = \frac{10^3}{2} \tan 45° = \frac{1000}{2} \times 1$$

$$\therefore H = \frac{180}{500} = \cdot 36.$$

In the broad side on. $\frac{M}{H} = d^3 \tan\theta$.

$$\frac{180}{\cdot 36} = d^3 . \tan 45° \text{ (Same deflection)}$$

$$\therefore d^3 = 1 \times \frac{180}{\cdot 36} = \frac{18000}{36} = 500.$$

The distance in which the magnet would produce the same deflection = $\sqrt[3]{500}$

= 7.94 c.m.s.

(28) It is placed in the east to west direction

$$\frac{M}{H} = \frac{d^3}{2} \tan\theta. \quad H = \cdot 38 \text{ gauss}$$

$$\frac{M}{\cdot 38} = \frac{20^3}{2} \tan 45° = \frac{8000}{2} \times 1.$$

$M = 4000 \times \cdot 38 = 1520$ C.G.S units

The moment of the magnet = 1520 C.G.S

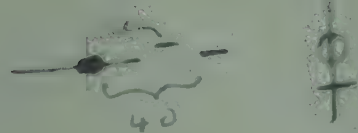
The length of the magnet = 8 c.m.s

∴ pole strength = $\frac{1520}{8}$ = 190. C.G.S unit

$$\frac{2Md}{(d^2-l^2)^2} = \frac{2 \times M \times 20}{(400-16)^2} = H \tan\theta = \cdot 38.$$

$$M = \frac{\cdot 38 \times 384 \times 384}{40} = 1401 \text{ C.G.S u}$$

$$m = \frac{1401}{8} = 175.1$$



1) It is placed in the east to west direction. The axis is $\perp$ to the earth's magnetic field. The axis produced passes thro the centre of the magnetometer.

When it is at 40 C.M.s, the deflection is 45°
When it is at 20 C.M.s the deflection is 30°.

$\frac{m_1}{m_2} = \frac{\text{pole strength of 1st magnet}}{\text{pole strength of 2nd magnet}} = \frac{\tan\theta_1}{\tan\theta_2}$.

$= \frac{\tan 45^\circ}{\tan 30^\circ} = \frac{1}{1/\sqrt{3}} = \frac{\sqrt{3}}{1}$. $m_1 : m_2 = \sqrt{3} : 1$.

~~$\frac{M_1}{M_2} : M_2 = \frac{d_1^3}{d_2^3}$~~

$\frac{M_1}{M_2} = \frac{d_1^3 . \tan\theta_1}{d_2^3 \tan\theta_2} = \frac{40 \times 40 \times 40}{20 \times 20 \times 20} \times \frac{\sqrt{3}}{1}$

$= \frac{8 \times \sqrt{3}}{1} = \frac{8 \times 1.732}{1} = \frac{13.856}{1}$.

$\therefore M_1 : M_2 = 13.857$.

1) It makes 50 oscillations in 250 seconds.

$\therefore$ In one minute the number of oscillation executed by this $= \frac{60 \times 50}{250} = 12$ oscillati

$\therefore n_0 = 12$.

distances are 10, 15, 20 c.m.s.

$d_1 = 10, d_2 = 15, d_3 = 20$.

Then the vibrating magnet makes 50 oscillations respectively

~~50 oscill~~ in 100, 137, 164 seconds.

$\therefore n_1 = \frac{60 \times 50}{100} = 30 . \quad n_1^2 = 900 .$

$n_2 = \frac{60 \times 50}{137} = \frac{3000}{137} . \quad n_2^2 = \frac{9000000}{137^2} = 479.5$

$n_3 = \frac{60 \times 50}{164} = \frac{750}{41} . \quad n_3^2 = \left(\frac{750}{41}\right)^2 = 334.5$

$n_0 = 12 . \quad n_0^2 = 144 .$

$n_1^2 - n_0^2 : n_2^2 - n_0^2 : n_3^2 - n_0^2$

$= 900 - 144 : 479.5 - 144 : 334.5 - 144$

$= 756 : 335.5 : 190.5 = f_1 : f_2 : f_3$

It is sufficient if we prove that

$d_1^2 (n_1^2 - n_0^2) = d_2^2 (n_2^2 - n_0^2) = d_3^2 (n_3^2 - n_0^2)$

~~$10^2 . 756$~~ .

$d_1^2 (n_1^2 - n_0^2) = 10^2 . 756 = 75600 .$

$d_2^2 (n_2^2 - n_0^2) = 15^2 . 335.5$

$= 335.5 \times 225 = 75480$

$d_3^2 (n_3^2 - n_0^2) = 20^2 . 190.5$

$= 400 \times 190.5 = 76200$

These are nearly equal.

$\therefore$ The ~~theory~~ inverse sq. law is verified.

Earth's field.

It oscillates 50 times in 80 seconds.

∴ In one minute the no. of oscillations = $\frac{60 \times 50}{80}$

$= \frac{60 \times 50}{80} = \frac{75}{2}$ oscillations.

under the action of a magnet.

It makes 50 oscillations in one minute.

$\therefore n_0 = \frac{75}{2}, \quad n_1 = 50.$

$H = k n_0^2 ; \quad f + H = k n_1^2 . \quad H = .36$

$.36 = k \cdot (\frac{75}{2})^2 . \quad \therefore k = \frac{.36 \times 4}{75 \times 75} = \frac{.16}{625} = \frac{16}{62500}$

$f + H = \frac{16}{625} \times 50 \times 50 = \frac{16}{25} = .64.$

$H = .36.$

$\therefore f = .64 - H = .64 - .36 = .28$

$f = \frac{2M}{d^3} . \quad d = 30. \quad .28 = \frac{2 \times M}{30^3}.$

$2M = .28 \times 30 \times 30 \times 30 = 27000 \times .28$

$M = 27000 \times .14 = 3780$ C.G.S Units.

(38) It executes 25 oscillation per minute, in earth field. ∴ $n_0 = 25$

When a bar magnet of length 10 c.M.s in

Then placed at a distance of 25 c.m.s fr... it, it makes 30 oscillations per minut...

$n_0 = 25$. $H = k . n_0^2$. $H = .36$.

$\therefore k = \frac{.36}{25 \times 25} = \frac{.36}{625} = \frac{36}{62500}$

$n_1 = 30$. $f + H = k n_1^2 = \frac{36}{62500} \times 30 \times 30$

$= \frac{324}{625}$.

$f = \frac{324}{625} - H = (.552 - .360)$ ~~$f = \frac{2M}{d^3}$~~ $\frac{2Md}{(d^2 - l^2)}$

~~$\frac{2M}{d^3} = \frac{2M}{\ }$~~ $\frac{2Md}{(d^2 - l^2)^2} = .55$.

$\frac{2 \times M \times 25}{(625 - 100)^2} = \frac{50 M}{525 \times 525} = .55$.

$M = \frac{.55 \times \overset{21}{\cancel{525}} \times 525}{\underset{2}{\cancel{50}}}$ =

$f = .55 - .36 = .19$.

$f = \frac{2Md}{(d^2 - l^2)^2} = \frac{2 \times M \times 25}{(50^2 - 10^2)^2} = \frac{50 M}{525 \times 525} = .19$

$\therefore M = \frac{.19 \times \overset{21}{\cancel{525}} \times 525}{\underset{2}{\cancel{50}}} = \frac{99.75 \times 21}{2}$

$= \frac{2094.75}{2} = 1047.5$. C.G... Unit...

39) It makes 16 oscillation at the earth's field.

$\therefore n_0 = 16.$ $H = k n_0^2 = .32 = k\, 16^2.$

$\therefore k = \frac{\cancel{.32}\ .02}{\cancel{16} \times 16} = \frac{.01}{8} = \frac{1}{800}$

when a bar magnet is placed, the number of oscillations = 20. $\therefore n_1 = 20.$

$f + H = k n_1^2 = \frac{1}{8\cancel{00}} \times \cancel{20} \times \cancel{20} = .500.$

$H = .320$

$\therefore f$ = Strength of the magnetic field = ·180 Gauss

(40) [

PJS

2-8-41

(40) It makes 100 oscillations in the earths field.

$\therefore H = k n_0^2.$ $.36 = k \cdot 100^2.$ $k = \frac{.36}{10000}$

A magnet is placed near the needle in the same line

Resultant field is H - F or F - H

according $H > f$ or $H < f$.

$H - F = k n_1^2$ or $F - H = k n_1^2$.

$k n_1^2 = \frac{.36}{1\cancel{00}\cancel{00}} \times \cancel{50} \times \cancel{50} = .09.$

$H - f = .09$ or $F - H = .09$.

$H > F$ Then $F = .36 - .09 = .27$

or $F < H$ or $F = .09 + .36 = .45$ } Ans

(41) It makes 20 oscillation per minute.
Time for one oscillation $= \frac{60}{20} = 3$ secs.
$T = 2\pi\sqrt{\frac{I}{MH}}$. $3 = 2\pi\sqrt{\frac{I}{MH}}$ where M is the moment of the magnet.
When it is remagnetised its pole strength is doubled ∴
∴ present Moment $= 2M$.

$$3 = 2\pi\sqrt{\frac{I}{MH}} \quad \text{—— (1)}$$

$$T_1 = 2\pi\sqrt{\frac{I}{2MH}} \quad \text{—— (2)}$$

Square Eq (1) and (2) and divide (2) by

$$\frac{9}{T_1^2} = \frac{4\pi^2 I}{MH} \times \frac{2MH}{4\pi^2 I}.$$

$$\frac{9}{T_1^2} = 2. \quad 2T_1^2 = 9. \quad T_1^2 = 4.5$$

$$T_1 = \sqrt{4.5} = \sqrt{4.5} \text{ secs}.$$

∴ The no of oscillations it will make

$$= \frac{60}{\sqrt{4.5}} = \frac{60}{2.1} = 28.28 \text{ oscillat}$$

(42) 1st place.
No ~~A~~ oscillations
A The period for one oscillation = 3 se

They are identical in all respects [illegible]

$\therefore I_1 = I_2$.

B. The period of oscillation = 4 sec.

Let M_1 be the moment of the ~~bar~~ A and M_2 be of B.

A $\quad T = 2\pi\sqrt{\frac{I}{M_1 H}} = 3$. —— (1)

B $\quad T = 2\pi\sqrt{\frac{I}{M_2 H}} = 4$. —— (2)

Square equations (1) and (2) and divide eq (2) by (1).

$\frac{B}{A} = \frac{4\pi^2 I}{M_2 H} \times \frac{M_1 H}{4\pi^2 I} = \frac{M_1}{M_2} = \frac{16}{9}$.

$\therefore M_1 : M_2 = 16 : 9$

The period of oscillation of A in 2nd place = 5.

$2\pi\sqrt{\frac{I}{M_1 H_1}} = 5$. —— (1)

$2\pi\sqrt{\frac{I}{M_2 H_1}} = x$ —— (2).

~~Sq~~ the 2 equations and divide eq (2) by (1).

$\frac{4\pi^2 I}{M_2 H_1} \times \frac{M_1 H_1}{4\pi^2 I} = \frac{M_1}{M_2} = \frac{x^2}{25}$.

But $\frac{M_1}{M_2} = \frac{16}{9}$.

$\frac{x^2}{25} = \frac{16}{9}$. $\quad x^2 = \frac{16 \times 25}{9}$

$\therefore x = \sqrt{\frac{16 \times 25}{9}} = \frac{4 \times 5}{3} = \frac{20}{3}$

$\therefore$ The period of B in the 2nd place = $6\frac{2}{3}$

(44) **A.** $T = 2\pi\sqrt{\frac{I}{M_1 H}}$ $\quad \frac{4\pi^2 I}{M_1 H} = \left(\frac{60}{15}\right)^2 = 4^2$ — (1)

$T = 2\pi\sqrt{\frac{I}{M_2 H}}$ $\quad \frac{4\pi^2 I}{M_2 H} = \left(\frac{60}{10}\right)^2 = 6^2$ — (2)

The equation are squared.

Divide eq (2) by (1).

$$\frac{4\pi^2 I}{M_2 H} \times \frac{M_1 H}{4\pi^2 I} = \frac{M_1}{M_2} = \frac{36}{16} = \frac{9}{4}.$$

$\therefore M_1 : M_2 = 9 : 4.$

Their moments of inertia are equal.

2nd place. A oscillates.

Let the horizontal intensity at that place =

$T = 2\pi\sqrt{\frac{I}{M_1 H_1}} = 6. \therefore \frac{4\pi^2 I}{M_1 H_1} = 6^2 = 36$ —

3rd place: B oscillation.

Let the horizontal intensity at that place

$T = 2\pi\sqrt{\frac{I}{M_2 H_2}} = 3. \quad \frac{4\pi^2 I}{M_2 H_2} = 3^2 = 9$ —

Divide eq 1 by eq (2).

$$\frac{4\pi^2 I}{M_2 H_2} \times \frac{M_1 H_1}{4\pi^2 I} = \frac{M_1 H_1}{M_2 H_2} = \frac{9}{36}$$

$\frac{M_1}{M_2} \times \frac{H_1}{H_2} = \frac{9}{36}.$ $\quad H_1 : H_2 = 1$

$\frac{9}{4} \times \frac{H_1}{H_2} = \frac{9}{36}. \quad \frac{H_1}{H_2} = \frac{9}{36} \times \frac{4}{9} = \frac{1}{9}.$ B

Electricity

(1) F = Intensity at the centre = $\frac{i \cdot ds \cdot \sin\theta}{r^2}$

Here $\theta = 90°$ ∴ $\sin\theta = 1$.

The number of turns 50. Radius = 5 c.m.

current = ·1 ampere. 1a = $\frac{1}{10}$ abs. $\frac{1}{10} = \frac{1}{100}$ abs.

$F = \frac{\cdot 01 \times 2 \times \pi \times 5 \times 50^2}{25} = 20\pi \times \cdot 01 = \cdot 2\pi = \frac{2}{10} \times \frac{22}{7} = \frac{44}{70}$

$= \cdot 629$ or $\cdot 63$ Gauss.

(2) Let the radius of the coil be r.

$F = \frac{i \cdot ds \cdot \sin\theta}{r^2} = \frac{i \cdot 2\pi r n}{r^2}$. (Absolute units)

$= \frac{10 I \cdot 2\pi r n}{r^2} = \frac{10 I \cdot 2\pi n}{r}$.

$F = \frac{10 \times 1 \cdot 8 \times 2 \times \pi \times 2}{r} = \cdot 4$.

$r = \frac{10 \times 1 \cdot 8 \times 2\pi \times 2}{\cdot 4} = \frac{72\pi}{\cdot 4} =$

$= \frac{i}{10} \cdot \frac{2\pi r n}{r^2} = \frac{1 \cdot 8}{10} \times \frac{2 \times \pi \times 2}{r} = \cdot 4$.

$r = \frac{1 \cdot 8 \times 4\pi}{10 \times \cdot 4} = \frac{7 \cdot 2\pi}{4} = \frac{1 \cdot 8}{1} \times \frac{22}{7} = \frac{39 \cdot 6}{7}$

$= 5 \cdot 66$ c.m.

③ The number of turns of coils = 50

The radius = 6 c.m.s.

Reduction factor = $\frac{10 \, r H}{2 \pi n}$ = k.

The current in amperes = Reduction factor × tan of the deflection

We know that c = k tan θ

where k is the reduction factor.

Find k or $\frac{10 \, r H}{2 \pi n}$.

Reduction factor = $\frac{10 \times 6 \times .3 \times 7}{2 \times 22 \times 50}$

= $\frac{6.3}{110}$ = .~~4~~573

④ $C = \frac{10 \, r H}{2 \pi n} \tan \theta$. (In amperes.)

Deflection = 23°. Diameter = 15 c.m.s. Radius = 7.5

The number of turns = 2. H = .38

$C = \frac{10 \times 7.5 \times .38}{2 \times \pi \times 2} \tan 23°$

= $\frac{75 \times .38 \times .4245 \times 7}{4 \times 22}$ = $\frac{2.9715 \times 25 \times 3 \times .19}{44}$

= ~~875~~ .96

.96 amperes.

6 .0772
=.36

(5) Radius = 10 c.m.s . No of turns = 5.

$f = \frac{2\pi n i}{r}$. (i absolute.) = H tan θ.

$i = \frac{r H \tan\theta}{2\pi n} = \frac{10 \times .35 \times .5774 \times 7}{2 \times 22 \times 5}$

= .0287 $\frac{\times 98 \times 2 \times 7}{44}$ = $\frac{1.4163 \times 2}{44}$. $\frac{2.82926}{44}$

$= \frac{2.15 \times .2887}{11} = 2.15 \times .02625 = .056437$

or = .05644 absolute

(6) $I = \frac{10 r H}{2\pi n} \tan\theta$. (amperes.

Deflection produced = 30°. ∴ Tan 30° = .5774.

Diameter of the coil = 20 c.m.s. , radius = 10 C.M.s = r

The number of turns = n = 10.

Horizontal intensity = .38 = H.

$I = \frac{10 \times r \times H \tan\theta}{2 \times \pi \times n} = \frac{10 \times 10 \times .38 \times .5774 \times 7}{2 \times 22 \times 10}$

$= \frac{1.9 \times .2887 \times 7}{11} = \frac{13.3 \times .2887}{11}$

$= 13.3 \times .02625$ = .349 amperes.

3-2

Śṛṅgāra Tilaka – 23 verses.
Rākṣasa Kāvya – a descriptive address of a lover to h[is] ...
barely of 20 verses. The style cannot be Kālidāsa's.
Ṛtusaṃhāra – Kālidāsa's. Glowing descriptions of nature and seasons with erotic sentiments interspersed. No other work giving his deep sympathy with nature & his powers of describing it.
Nalodaya – a poem in 4 cantos. This is attributed to Kālidāsa. The chief aim is to show off his skill in the construction of all metres and other things – purely artificial. Style speaks against Kālidāsa's authorship.
Ghaṭakarpara. One of the nine gems of Vikrama's court. His small poem extremely artificial. यमक employed. didactic poem – most of the verses imaginative and amusing. Freedom of language impeded by यमक.
Bhartṛhari – tradition makes him an elder brother of Vikrama of Ujjayini. great grammarian. Vākyapadīya & Sāra 2 standard works in grammar. In the lyrical field his position stands on his 3 Śatakas. They are collection of verses fit to be an instructive primer for a beginner – not much of poetic beauty – but some stanzas noted for their lyrical harmony.
मू. Tradition makes him a contemporary of Śankara. His poem in praise of देवी is known as पञ्चशती. Consists of 5 centuries of verses which are highly devotional and distinguished by fine melody and rhythm. Tradition assigns him to the 8th century. Style compares favourably with Śankara's lyrical panegyrics. Vocabulary & diction.
Śankara 8th century apart from his eminent contribution to Vedānta, his fame as a lyrical poet – rests on the following
– शिवानन्द लहरी . शिव स्तोत्र dedicated to Śiva, सौन्दर्य-लहरी, 100 verses praising Pārvatī. शिव भुजङ्ग स्तोत्र – 37 verses of the भुजङ्ग प्रयात metre in praise of Śiva

[?] image everywhere musical. Bhakti is transcendent
overflowing throughout.
Bhallata - S'ataka called after him resembles the Ni[ti]
S'ataka of Bhartṛhari. Inanimate objects are ad[dressed]
instruction in morals. Quoted by Kṣemendra & Abhi[navagupta]
∴ 8th century verses strained but ideas fine & poetic.
Amaru s'atakā. attributed to Amaru. By orthodox
tradition this poem was attributed to S'ankara w[ho]
thro' transmigration into the body of king Ama[ru]
Quoted by Ānandavardhana who flourished in the
century. Tradition also shows that they were alm[ost]
contemporaries.
[Devanagari] - A Brahmin of Southern India, by divi[ne]
gift composed Hari Vilāsa. Kṛṣṇa's advent to the
house to the message of Mādhava. In Vaikuṇṭha's
a contemporary of
- ~~[illegible]~~ (Bhojā) - 10th century
Jayadeva. Gita Govinda. about 1116 A.D. - the end of the
century & the first part of the 12th century, 12 sarga[s]
and each contains 24 [Devanagari]. a chorus followi[ng]
by 8 feet, chorus repeated. Work noteworthy & o[ne]
of the few come down to us from a remote anti[quity]
and gives us an insight into the music at the tim[e]
Govardhana's Āryasaptas'ati - an eminent prod[uction]
referred to by Jayadeva - so lived at the end of
11th century.
Lokanātha or [Devanagari] - Tradition says that he h[ad]
a concubine named [Devanagari] who preached to h[im]
Bhakti to Kṛṣṇa. After his death he was born [as]
Jayadeva and wrote the Gita Govinda. In the

Narayana ... composed ... [illegible]
must be assigned to the close of the 11th century. ई [illegible]
a lyric in praise of ई[illegible] - 3 parts of 100 and odd stanzas
It's a significant name - the verses are a treat to the ear
for their music and harmony they are worth learning by heart.
The ideas there are so chosen and depicted that they are
well adapted for being represented by gesture dancing or
अभिनय.
Kṣemendra . [illegible] 1 moral aphorisms in simple ...
pleasing picture of the virtues & vices of Kāśmīr at his time
Bilhaṇa 12th century. His lyrical work was the [illegible]
[illegible] - 50 verses - recapitulating his pleasures with [illegible] -
[illegible] when he was about to be executed for his proposing
(her hand) of marriage - this verse obtained him pardon and her hand.
standard of delightful lyric.
श्रीधरदास . सदुक्तिकर्णामृत . beginning of the 13th century 1205
A.D. anthology of verses. Extracts from about 400 poets.
मेरुतुङ्ग - Jain by religion historical taste - प्रबन्ध
चिन्तामणि in 1306 AD = 18 of the प्रबन्ध treats of the
history of 19 [illegible]
शार्ङ्गधर . His grandfather Raghavadevaji was the minister
of Hammira who reigned at Chittoor in the 13th century
so his work can be assigned to about the middle of
the 14th century. His Paddhati is an anthology of about
6000 verses, culled out from 264 different authors
in 116 [illegible] he brings together gems of Sanskrit Poetry under
various headings.
राजशेखर. He was assigned to about the end of the
14th century प्रबन्धकोश a collection of half historical
tales of biographies. The style resembles that of

the ?rika Tantra. His patron was ... the ... of ...
a favourite of Mahammud Taghluk.

वैदान्तदेशिक:यादव्याभ्युदय 14th century. ... 25 ... on the
model of Kalidasa's standard work. His ... & ... the ...
the well known story of Rama & ... the ...
of fiction - scene laid in Pampa lake. The ...
may be found wanting in criticism of life; ...
western critics. One critic says: every stanza is ...
a clean diamond & the whole forms a treasure ...
pious offering at the feet of Rama. सुभाषितनी...
ethical piece in 12 paddhatis.

...ने ... , ...
... ... unlimited
... सङ्कल्पसूर्योदय a philosophical drama,
Jagaddhara. 15th. century - his grandfather a contemporary of Ki...
of Kashmir 1482 - 1484. He flourished abou...
स्तुतिकुसुमाञ्जलि praising several deities. His ...
-logical mastery is most wonderful.

... Govind Thakkur alludes to ...
in his Kavya Pradipa 1460 AD, it flourished ab...
1368 AD. 3 small poems. - the ...
... (Prakrit poem) ...
last a collection of panegyrics in different ver...
-culars. The ... another work ...
-his. Style was musical and refined ...
Gattu Bhatta - His contribution was प्रसङ्गरत्ना...

आहारे विरतिः समस्तविषयग्रामे निवृत्तिः परा।
नासाग्रे नयनं तदेतदपरं यच्चैकतानं मनः॥
मौनञ्चेदमिदं च शून्यमखिलं यद्विश्वमाभाति ते।
तद्ब्रूयाः सखि योगिनी किमसि भोः किं वा वियोगिन्यसि॥

अत्र तवाहारविषयकरागाभाव एव न तु योगिनीवदाने ष्ट - साधनताज्ञानात् योगप्रतिकूलाहारान्निवृत्तिरिति तस्याः प्राणधारणार्थमाहारोऽस्त्येव। तव तु सोऽपि नेति विषय-सम्प्रया:, योगसाधने यदृच्छोपागते च विषये तस्याः प्रवृत्तिस्तव सर्वथैव विषयान्निवृत्तिरिति समस्तेति विशेषणस्य, ध्यानसमय एव तस्या नासाग्रनेत्रत्वम्, चित्तैकाग्र्यं च तव तु सर्वदैव तदुभयं तथैव तादृश अर्थबोधरहितं मौनं चेति तदेतदिमिति क्रमात् सर्व-नाम्नः, त्वं वियोगिन्येव न तु योगिनी इति उत्तरपक्ष-दार्ढ्यस्य सूचकस्य वेति निपातस्य च

When the accelerating causes of the mundane worldly sentiment of love such as a beautiful damsel and pleasure garden and both are presented through the medium of poetry, they can never be expressed by these words directly through the primary capacity of words, but they can be expressed only through the transcendental Vibhavas through the power called Vibhavana which they possess. And that permanent condition is suggested by these वासनाs which are experienced by all in common. It remains as the impressions derived from previous birth of the spectators, thus responding through all hearts. Its very life consists only in its being realised; and thus it continues to be experienced only as long as the Vibhavas are presented. It then becomes luminous externally and internally; it embraces afterwards as it were the whole body, making us plunge in an ocean of joy, as it were, we forget all other things for the time being and recapitulate the sentiment of erotics and others which generate transcendental bliss.

ಸುಖವು| [illegible] ಮಹಿಮೆಯಲ್ಲಿ ಕಾಲ [illegible]
[illegible] | ಮಾಡಿ [illegible] ಶ್ರೇಯಸ್ಸು [illegible]
[illegible] ||

ಮಾಡಬಾರದು ಎಂದು ಬಾರದು [illegible] ||
[illegible] ಬಾರದು | [illegible]
[illegible] ತನ್ನ [illegible] ಬಾರದು | [illegible]
[illegible] ಇನ್ನು [illegible] | [illegible]
[illegible] ಬಾರದು [illegible]
[illegible] ತಂದೆ ಮಾಡಿ [illegible]
[illegible] ಬಾರದು ||
ನಂತರ [illegible] |
ಮಾಡಿದರೆ [illegible] ಬಾರದು [illegible]
[illegible]
[illegible] | ತನ್ನ [illegible]
[illegible]
[illegible] | [illegible] ಮಾಡಬಾರದು
[illegible] ||
[illegible] ಬಾರದು [illegible]
[illegible] ತನ್ನ [illegible] ಬಾರದು | [illegible]
[illegible] | [illegible] ಮಾಡಬಾರದು
[illegible] ಬಾರದು || [illegible] ತನ್ನ [illegible]
[illegible] || [illegible]
[illegible] | [illegible]
[illegible] ಬಾರದು [illegible] |

assigned to 1416 A.D. a collection of miscellaneous, moral, rules for personal ceremonies & conduct sketch of individual biography. proverbial expressions are abundant ideas short & concise. whole work written in a flowery style language shows much of literary acquaintance. very little history in it.

Dhanadarāja. like Bhartṛhari composed 3 Śatakas in 1434 A.D. the language subject to ornamentation. ideas more advanced & more artfully clothed.

सायण — elder brother of Mādhava & prime minister of king Kampa brother of Bukka. 15th century. Sudhānidhi anthology of 84 पद्धतिs. meant to eulogise his patron. inculcate the duties of a king.

Rāmacandra — रसिकरञ्जनं — in 1524 A.D. — Love is the theme in one part, and the other part refers to renunciation. Language learned though not musical. He might be the same as the grammarian the author of the प्रक्रियाकौमुदी.

S'rī Hari — a contemporary of Emperor — 1556-1605. शृङ्गारावली — a wide collection of verses of lyrical beauty.

Didactic Poetry. Pañcatantra, Hitopadeśa are the only surviving specimens serving as useful handbooks of moral philosophy — illustrates the variety of mundane existence — illustrates the doctrinal scheme of all didactic poetry. Mahābhārata is an inexhaustible mine of proverbial sayings and as such the earliest work on didactic poetry.

ಸಾಯದಂತು ಅಷ್ಟು ದಿಙ್ಕ್ಷ್ಟಿ ತಿರು ನಾಟ ಯುಕ್ತಿಯು
ಬಾರದು । ಬಾನ ಧ್ಯಾನ ಕೆಯಿಕಿಂ ಬಾರದ್ದೆ ತಾನು
ನಕ್ಕೆಲವ ಬಿ ಠ ಬಾರದು । ~~ಅಷ್ಟು~~ ನಾಡಿ ಜಿಹ್ವೆ ಯ ನಾಥ
ಯಾನು ಕ ಠು ಕಿ ಲ ಕಿ ಲ ಕಿ ಲ ನೆನ ಕಾ ಡಿ ಬಾರದು ।
ಬಾರದು ದಕ್ಕಿ ದಿ ಹರಿ ಯ ಬಾಯಿ ನಾಡಿದೆ ಬಿ (ಬಾರದು
ಶಿವ ॥ ನಾಧಾಸ್ತಿತ್ವ ನಿ. ಮಾನ ಬಿಡ ಬಾರದು ॥

branch - erotic branch. The earliest emp[illegible]
the religious branch are to be found attested in [illegible]
in the संहिता of the अथर्ववेद songs & magic spells
and exorcising charms. But in no way do they display
a decayed state of society overcome by superstitious terr[or]
With ref. to these hymns a remark was made
by Weber - 'The hymns are no longer the expression
of direct religious emotion'. They are simply clothed
in that form. This ~~[illegible]~~ is inconsistent on the face of it,
If there had been no sincerity there would have been
no necessity for these incantations. Sincerity is pro-
minent in the environments of the Atharvaveda.
They were using them because they were efficacious
The very fact that they were custodians and main-
tained them is a standing monument of an unmista-
kable evidence of their sincerity in regard to
religious fervour.

Next to that, the lyrics & the glowing measures
poetic prayers in praise of particular deities or
goddesses as the occasion demands. In the Tantra
literature, they find their classical expression.
(Pance Tantra). In the developt of such lit. the following
considerations are supposed to have given them the
necessary incentive to multiply such lit & to main-
tain it thro' generations in its original purity. They
are: ~~Bory It is~~ to seek the favour of any god,
it was felt necessary to repeat in his praise as
[illegible] of him as possible

l... -mindedness, charitableness and ...
been now it is the case. If you go to any one for
business, you will preface it by referring to his ...
character. The ~~two~~ 108 named prayers- अष्टोत्तरशत
नामावली, सहस्रनामावली form a class by the...
लक्षार्चनम् and श्रीरामकोटि [writing Srī Rāma a crore of times]. To this category belong
the prayers in amulet form रक्षा० - to ...
any evil influences - ... inscribed on a ...
plate and rolled and worn round the neck. ...
a prodigious virtue is ascribed and it main...
its efficacy even today.

The modern forms of these religious lyrics are ...
embodying not only philosophical ideas ... which ...
composed by Kalidasa & Sankara, ~~but also~~ and ideas
devotion as in the ... and ..., but ...
the finest touches of poetic art and imag...
...also. Besides the philosophical & devo...
ideas flowing through them, they ~~are~~ contain fine ... and enhance...
of aesthetic art and are composed in elegant ...

12/1/25. (The erotic branch)
The earliest lyric poet known by tradition is Kalidasa ...
whose lyrical work is the Meghaduta of about 100 stan...
Yaksa separated by a curse from his wife, addresses ...
cloud as a friend. Route described very graphically. ...
gave much scope for manifestation of his art, model of ...
later imperfect imitations

Syamaladandaka - a panegyric addressed to Saraswa...
attributed to him.

[illegible]

[illegible] శివ కళ్యాణోత్సవ [illegible]

న [illegible] నయాయెను । [illegible] వస్త్ర [illegible]

[illegible] లక్ష్మి న [illegible] ॥ పల్లవి ॥ [illegible]

[illegible]

[illegible] । శివ కళ్యాణ [illegible]

[illegible]

[illegible]

[illegible]

[illegible] ॥ [illegible]

[illegible] । [illegible]

[illegible]

[illegible] ॥

[illegible] ॥ శివ కళ్యాణ [illegible]

[illegible]

[illegible] ॥ [illegible]

[illegible] ॥ [illegible]

[illegible] ॥ [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible] । [illegible]

[illegible]

[illegible]

Dislike for food, extreme nonattachment as regards all the senseobjects, the eyes concentrated on to the tip of the nose, and what is more a completely absorbed mind, this silence, and the whole world appearing as though it were vacant, — all these are found in you: tell me, o dear friend, whether you are a yōgini, an ascetic, or a viyōgini suffering from the pangs of separation?